THE MODEL ENGINEER

IN THIS ISSUE

● I.C. POWER FOR THE WORKSHOP ● A TELESCOPIC TRIPOD THE PHYSICAL SOCIETY'S EXHIBITION ● READERS' LETTERS ● A 10 c.c. GENERAL-PURPOSE FOUR-STROKE ● MODELS OF INDUSTRIAL PLANT ● RADIO-CONTROLLED MODELS IN B.A.O.R.

JUNE 2nd 1955

Vol. 112 No. 2819

9D

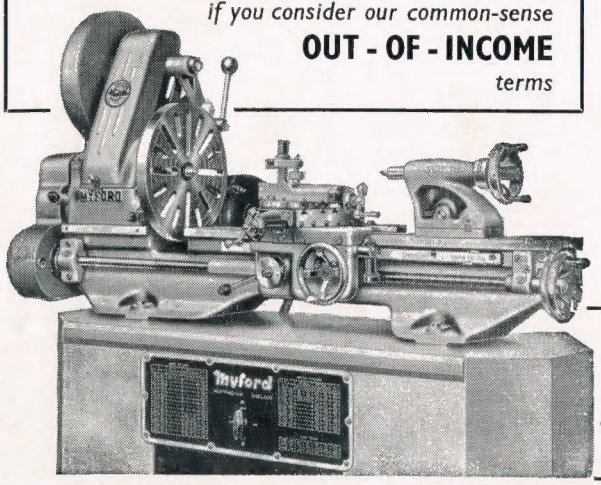
THINK OF ALL THE VALUABLE WORK YOU CAN COMPLETE WITH A **MYFORD LATHE!**

IT NEED NOT BE EXPENSIVE . . .

if you consider our common-sense

OUT - OF - INCOME

terms



PLAN YOUR EXPENDITURE

KNOW just how much you PAY

MYFORD M.L.7 bench lathe with standard equipment **£51 . 17 . 6**

Deposit **£7 . 17 . 6** and 12 monthly payments of **79/7**
or 18 monthly payments of **55/3**
or 24 monthly payments of **42/11**

MYFORD SUPER 7 bench lathe with standard equipment **£78 . 10 . 0**

Deposit **£13 . 2 . 3** and 12 monthly payments of **118/3**
or 18 monthly payments of **82/1**
or 24 monthly payments of **63/9**

STREAMLINED SERVICE

IMMEDIATE DESPATCH FROM STOCK

WE PAY CARRIAGE OUT (Mainland only).
May we quote for your individual requirements? Detailed quotation sent by return post quite free of obligation. Illustrated MYFORD literature gladly sent.

" The choice of experience "

A. J. REEVES & CO

416 MOSELEY ROAD, BIRMINGHAM, 12

Grams : " Reevesco, Birmingham " *Phone : CALthorpe 2554*

BLUEPRINTS OF L.B.S.C. LOCOS

5"	Gauge	4-4-0	Maid of Kent	set of 11	...	£2 7s. 6d.
3½"	,,	4-5-2	Britannia	,, 16	...	£3 0s. 0d.
3½"	,,	4-6-2	Hielan' Lassie	,, 11	...	£1 18s. 6d.
3½"	,,	4-6-2	Pamela	,, 13	...	£2 4s. 6d.
3½"	,,	4-6-0	Doris	,, 12	...	£2 1s. 0d.
3½"	,,	4-4-2	Maisie	,, 8	...	£1 7s. 0d.
3½"	,,	4-4-0	Miss 10 to 8	,, 8	...	£1 7s. 0d.
3½"	,,	T0-6-0	Molly	,, 6	...	£1 1s. 0d.
3½"	,,	0-6-0	Iris	,, 7	...	£1 4s. 6d.
3½"	,,	T0-6-0	P. V. Baker	,, 6	...	£1 1s. 0d.
3½"	,,	T0-4-0	Juliet	,, 6	...	£1 1s. 0d.
3½"	,,	0-4-0	Canterbury Lamb	,, 9	...	£1 2s. 6d.
3½"	,,	T0-4-0	Tich (large)	,, 10	...	£1 5s. 0d.
3½"	,,	T0-4-0	Tich (small)	,, 8	...	£1 0s. 0d.
3½"	,,	0-2-2	Rainhill	,, 4	...	14s. 0d.
2½"	,,	2-8-0	Austere Ada	,, 7	...	£1 1s. 0d.
2½"	,,	4-6-2	Fayette	,, 9	...	£1 7s. 0d.
2½"	,,	4-6-0	Olympiade	,, 7	...	£1 0s. 0d.
2½"	,,	4-6-0	Purley Grange	,, 6	...	18s. 0d.
2½"	,,	2-6-0	Dyak	,, 7	...	£1 1s. 0d.
2½"	,,	0-6-0	Southern Maid	,, 5	...	15s. 0d.
0	,,	4-6-4	Josie	,, 5	...	12s. 6d.
0	,,	4-6-2	Sir Morris	,, 5	...	12s. 6d.
0	,,	4-4-0	Bat	,, 5	...	12s. 6d.

Mechanical Lubricators ...	each 3s. 6d.	
Donkey Pump	,, 3s. 6d.	
Weir Pump	,, 2s. 6d.	ALL POST FREE
4-Wheel passenger Truck ...	,, 3s. 6d.	
Injectors	,, 3s. 6d.	

L.M.S. 0-6-0 Tank in 5" Gauge. " Butch " by Kennions, set of 12 blueprints, £2 5s. 0d.

L.M.S. 0-6-0 Tank in 5" Gauge. " Twin Sisters " by J. Austen-Walton, set of 38 blueprints, £5 19s. 6d.

Castings are in stock for any of the above; we shall be pleased to quote for same. Return Post Service.

TOOL AND MATERIALS CATALOGUE, 9d.

Boilers Brazed — Tested — Completed or made to your or our own specifications.

Overseas orders a speciality.

KENNION Bros. (Hertford) Ltd.

(Phone 2573) HERTFORD, HERTS

OPEN DAILY 8.30 a.m. to 6 p.m.

WE CORDIALLY INVITE

model engineers to call in at our showrooms and inspect the extensive range of tools and instruments on view there. We can supply everything from a lathe to the smallest pair of pincers. A visit would be worth while!

E. GRAY & SON

12-14 CLERKENWELL RD., E.C.1

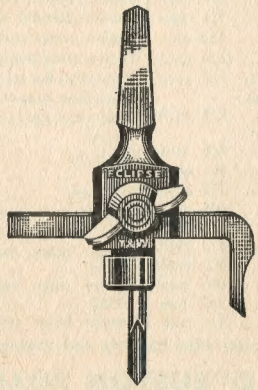
'Phone : CLErkenwell 1174/5

'Grams : MATERIALS, SMITH, LONDON

240-1D

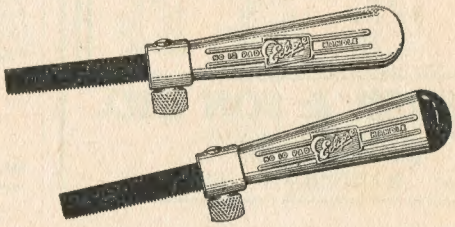
Eclipse

the name for good tools



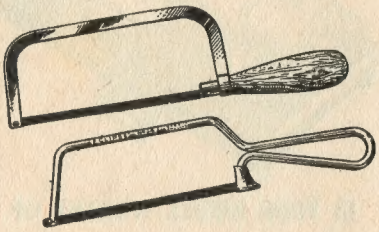
TANK & WASHER CUTTER

A dual purpose tool for use in a carpenter's brace for cutting holes in tanks, sheet-metal, etc., and for cutting washers from leather, rubber, plastics, etc. Price **21/-**



PAD HANDLES

For short stroke sawing with a new or broken hacksaw blade or key hole saw blade. Available either in tough plastic (No. 10) or metal (No. 12). Price **4/-** each.



JUNIOR SAW FRAMES

No. 670 for the craftsman—with a comfortable handle. No. 14J for general use in workshop, garage, garden, home or farm.
Prices No. 670 **4/3**, 14J **1/9**

4S TOOL

A handy set of tools for garage and general use, for sawing, scraping, slotting and screw-driving, complete in metal box. Price **13/9**

Made by James Neill & Co. (Sheffield) Ltd., and obtainable from all tool distributors

U 3/2

BRING YOUR "ML7" UP-TO-DATE

Perhaps you have decided to bring your MYFORD "ML7" Lathe into line with the latest developments. The following shows how it can be done easily and quickly to your own particular requirements. Contact us TODAY—we shall be happy to quote against your list without obligation.

Code	Description	£	s.	d.
5938	6-in. × 4-jaw Ind. Screwed Body Chuck	6	14	0
10941	4-in. × 3-jaw G.S. GRIPTRU Screwed Body Chuck	10	7	0
9407	Countershaft Clutch Unit fitted Swing Head	6	17	6
9254	Rear Toolpost	1	17	6
9255	Long Cross Slide	2	17	9
9410	Lathe Cover	1	9	2
9408	Fine Feed Tumbler Cluster Gear ..		11	6
1439	2 × 21T Metric Changewheels ..		13	0
	CARRIAGE PAID TO YOUR DOOR	£31	7	5

PERSONAL H.P. PLANS FOR ABOVE

Suggested Deposit	Monthly Payments 12 at	18 at	24 at
£3 17s. 5d.	50s. 10d.	35s. 7d.	27s. 11d.
£6 7s. 5d.	46s. 8d.	32s. 10d.	25s. 10d.
£10 7s. 5d.	40s. 0d.	28s. 4d.	22s. 6d.

Or to your own requirements.

T. GARNER & SON LTD.

Hand and Machine Tool Division

6-8 Primrose Hill

Phone BARNSLEY 2908

¾" Scale "Royal Scot" Castings

Set of drawings 30/-

Castings

Driving wheels ...	3/10	each
Bogie wheels	1/6	each
Tender wheels ...	2/-	each
Cylinder body	21/-	each
„ valve liner ...	3/6	pair
„ back cover ...	3/-	each
„ front cover ...	2/-	each
„ steam chest cover ...	2/-	each
„ glands ...	2/-	pair
Buffer stocks	10d.	each
Main stretcher ...	13/9	each
Motor plate stretcher	2/6	each
Buffer plank angles, inside	2/6	each
Buffer plank angles, outside	2/6	pair
Drag plate	9/-	each
Bogie pin stretcher ...	3/3	each
Bogie stretcher ...	3/6	each
Bogie pad	1/3	each
Bogie equaliser spring	1/-	each
Bogie control bracket	9d.	each
Bogie horns	6d.	pair
Main horns	1/2	pair
Bogie hanger bracket ...	1/-	pair
Main axleboxes ...	2/6	each
Bogie axleboxes ...	1/9	each
Motion plate	2/6	each
Valve gear bracket ...	3/-	pair
Steps, loco and tender	2/6	each
Front steps, loco ...	1/8	each
Tender horns	9d.	each
Tender axleboxes ...	2/4	each
Tender buffer plank ...	2/6	each
Tender dummy springs	1/-	each
Engine pump and strap	5/6	pair
Tender hand pump ...	14/-	each
Smokebox barrel ring	8/-	each
Smokebox support ...	7/6	each
Smokebox door and ring	7/6	each
Funnel	4/-	each
Petticoat	6/6	each
Dome	3/-	each
Splashers	1/9	each
Displacement lubricator	12/-	each
Inner dome and ring ...	4/-	pair
Tender dome cap and ring	5/6	pair
Tender filler cap and ring	2/4	pair
Tender inner splashers	1/2	each

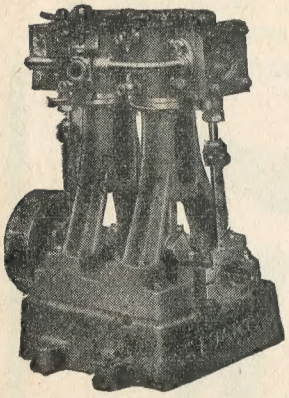
All Prices Plus Packing and Postage

BOND'S O' EUSTON ROAD LTD.

357, Euston Road, London, N.W.1

Est. 1887 Phone: EUSton 5441-2

STUART



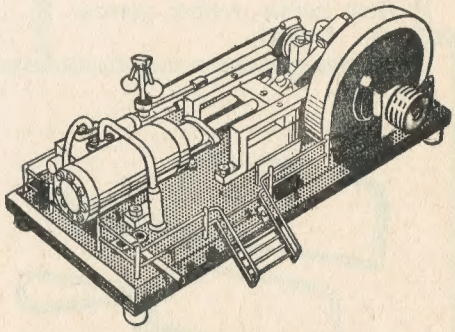
THE DOUBLE 10 ENGINE

Set of castings and all other materials, screws, etc., with working drawing and instructions, £2 0s. 0d. Purchase Tax 6s. 8d.

Other engines, fittings and model supplies are in our catalogue — — — 6d. post free.

STUART TURNER LTD

HENLEY-ON-THAMES, OXON.



IS YOUR MODEL WORTHY OF THE

Best Finish?

A paint to be satisfactory to a model maker must do three things. It must go on easily, obliterate well, and dry quickly to a hard glass-like finish. Robbialac Lacquer does them all. It is available in black, white, silver and 24 colours, from all good paint dealers and cycle shops, in ¼-pint tins at 1/6d. and larger sizes.

ROBBIALAC LACQUER

FREE: Send 1½d. stamp for free Instructional Leaflet to Dept. 7L6 Jenson & Nicholson Ltd., Carpenters Road, London, E.15

THE
MODEL ENGINEER
ESTABLISHED 1898

Managing Editor E. F. H. COSH
Technical Editors
J. N. MASKELYNE, A.I.Loco.E.
E. T. WESTBURY
E. BOWNESS, A.I.N.A.
Features Editor J. D. McLINTOCK
Advertisement Manager C. T. PAGE

Volume 112 - No. 2819
JUNE 2nd - 1955

CONTENTS

SMOKE RINGS 605
A TURNS COUNTER
A Useful Aid for Coil Winding in the Lathe 606
MODELS OF INDUSTRIAL PLANT ... 608
A 10 c.c. GENERAL-PURPOSE FOUR-STROKE 611
THE PHYSICAL SOCIETY'S EXHIBITION 614
IN THE WORKSHOP
A Home-built Power Unit 616
NEVER AT A LOSS !
The Tale of a Backwoods Engineering Problem 619
L.B.S.C.'s "NETTA"
Regulator and Superheater for the 3½-in. Gauge Engine 620
A TELESCOPIC TRIPOD WITH PAN AND TILT HEAD 624
QUERIES AND REPLIES 628
THE S.S. "ROBERT ALLEN"
The Story of a Radio-controlled Cargo Liner 629
READERS' LETTERS 632
RADIO-CONTROLLED MODELS IN THE B.A.O.R. 633
WITH THE CLUBS 634

OUR COVER PICTURE

Capt. N. A. F. Edwards, R.E., Garrison Engineer, B.A.O.R., is seen with his 1/12-scale, radio-controlled Austin 3-ton truck, one of a number of models that have won him first prizes at Arts and Crafts exhibitions and astonished his colleagues, as well as the natives, in various parts of the world where he has shown and demonstrated the models. The interesting and amusing story is published, together with another photograph, elsewhere in this issue.

SMOKE RINGS

"Steam Locomotive" Exhibition

FROM NOW until October 29th, the British Transport Commission is holding an exhibition illustrating the work of eight great locomotive engineers: Robert Stephenson, John Ramsbottom, Edward Fletcher, Patrick Stirling, Samuel Johnson, Dugald Drummond, George J. Churchward and Nigel Gresley. The display comprises models, personal relics, drawings and other interesting items; it should not be missed by anyone who is interested in the development of the steam locomotive. It is open every day, from 10.0 a.m. to 7.0 p.m. on weekdays and 2.0 p.m. to 7.0 p.m. on Sundays, in the Shareholders' Meeting Room at Euston Station, London, N.W.1.

Technical Information

ON SEVERAL occasions recently we have found it necessary to approach manufacturers of various types of machinery for technical information on their products, mostly for the purpose of answering readers' queries on these matters, and we have been struck by the apparent reluctance of many of them to supply drawings or explanatory data on the construction and operating principles of the machines in question. The usual response to such enquiries elicits a brief reply, with an enclosure of leaflets or catalogues, generally showing the external appearance of the machines and a drawing to indicate fitting dimensions of the various types and sizes—but little or nothing to show their internal construction or working principles. This literature is, of course, prepared mainly for the information of prospective buyers; but is one, therefore, to accept the implication that they are not interested in the technical details, and require only to know what the machines look like, and how to fit them? We find it difficult to believe that such is the case, but in several cases, the reply to our request for further information has not been very well received, and it is clear that such requests are regarded as unusual. It is only fair, however, to say that there are several exceptions to this attitude, and some firms have shown their willingness to help in any possible way in respect of technical enquiries; to the rest, we would assure them that failure to supply all the information asked for by interested querists cannot, in the long run, be good for trade.

Exchange Wanted

MR. HARRY QUICK, 1115 East Center Street, Mahanoy City, Pennsylvania, U.S.A., tells us that he has a collection of photographs of ½-in., ¾-in. and 1-in. scale locomotives in operation on club tracks, and he wonders if any reader would care to exchange some English club pictures with him. Mr. Quick is the builder and operator of some fine live steamers, and is, judging by his letters to us, a dyed-in-the-wool steam enthusiast. We print his address above, so that any interested reader may write to him direct.

A Canadian "Meet"

WE LEARN that the Red River Valley Railway Manitoba Live Steamers Association will be holding its annual International Live Steam "Meet" for all lovers of small-gauge locomotives on September 3rd, 4th and 5th next, in Winnipeg. A cordial invitation is extended to all kindred spirits, and anyone intending to be present should write for full information to Mr. M. G. Winslow, 635, Garfield Street, Winnipeg, Canada.

A Sharp-eyed Youngster

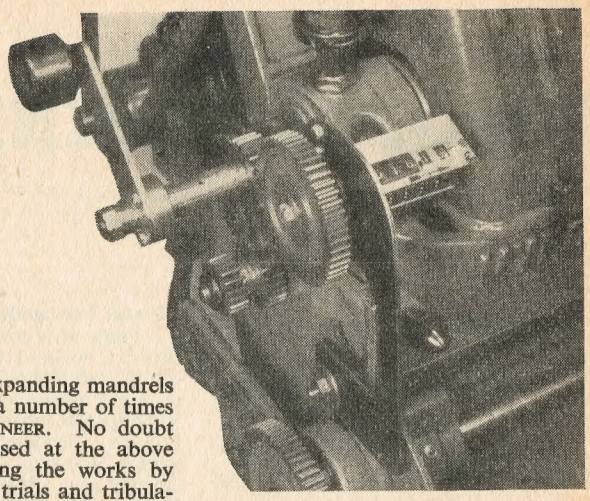
SLIPS OF the pen can and do occur, even in the best-regulated editorial offices, and we make no claim that our editorial office is any exception to the general rule. Since the "M.E." Diary reappeared in our Club pages on March 31st, the dates of the forthcoming "M.E." Exhibition have been announced each week. On Friday, May 13th (lucky day !), we were asked why the date August 23rd was omitted. We did not know ! Not only that, but, to our dismay, we discovered that, so far, at time of writing, it has not been included in any of the announcements. It will, in future, because there is no particular reason for its omission. A sharp-eyed lad at Enfield Technical College called our attention to the error.

Published every Thursday by PERCIVAL MARSHALL & COMPANY LTD., 19-20 NOEL STREET, LONDON, W.1
Telephone: GERrard 8811 Annual Subscription £2.2s.0d. post paid. (U.S.A. and Canada $6)

A TURNS COUNTER

A USEFUL AID FOR COIL WINDING IN THE LATHE

By L. Frater



The turns counter in position on a Myford ML7 lathe

THE writer has the good fortune to be the possessor of an ML7 lathe, the acquiring of which put his bank balance well into the red. Because of this, it has proved necessary to use it in many ways, never intended by the manufacturers. One of these improvisations has been to utilise the lathe for the winding of coils, transformers, etc. Although this admittedly savours of using a steam hammer to crack a nut, on the whole it has been quite successful, and the following notes are an outline of some of the problems, and the failures encountered in solving them.

Some consideration was given to the possible construction of a proper coil winder, but this was hastily abandoned, as it was realised that to make a satisfactory job of it, meant a lot more work than was justified by the use it would get. After all, and in spite of the meticulous, who regard the making of tools and fittings as an end in itself, the writer must confess to be one of the individuals, who thinks of them as a means to an end, with the result that some of his efforts have a more than close relationship with the designs of the late Mr. Heath Robinson, and not infrequently are a complete flop. In addition to this, it would have to be a comparatively bulky piece of equipment, for which precious workshop space would have to be found. As this was virtually non-existent, and furthermore, as most of the wire used comes from salvage, such as, old transformers (400 c/s variety), I.F. transformers, etc., which meant a weird collection of gadgets to hold them, all taking up space, it was obvious that there was no alternative, and the lathe would have to be used.

As a start, therefore, a handle was made and fitted to an expanding mandrel, which, inserted at the rear end of the headstock, enabled winding to start at a nice sedate pace.

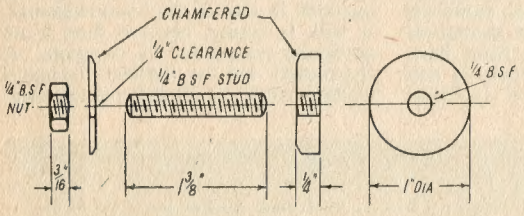


Fig. 1. The mounting stud

Suitable types of expanding mandrels have been described a number of times in THE MODEL ENGINEER. No doubt eyebrows will be raised at the above implication of turning the works by hand, but after many trials and tribulations it was found, that, although naturally much slower than power drive, it was quite satisfactory, if somewhat tedious. On occasions, the tortoise *does* beat the hare !

Attempts were made to use power drive, but with fine wire the difficulty of starting slowly enough, and without snatch, to avoid breaking the wire, even at slow speeds, proved unsurmountable, except, with the heavier gauges, and the necessity for power drive for this was not great, as usually only a relatively small number of turns are required of the more robust wire.

Slipping the driving belts was also tried, but proved to be unsatisfactory, due to snatch, V-belts having the habit of trying to wrap round the pulleys when slack. It is possible that a smoother start could be made with a flat belt drive. A further disadvantage is the additional wear on the belts, which are somewhat expensive, besides being troublesome to fit. The real answer, of course, is a proper countershaft clutch unit.

Experience of hand winding has shown that it is not so bad as it seems, and infinitely better than the previous set-up, using a hand-brace clamped in a vice.

One fitting which has been found essential is a means of counting the turns automatically, as the writer has never been able to count over a hundred without losing the place; a failing, it is imagined, that he shares with others, and as for counting a few thousand—well just impossible ! Provision of a turns counter has the following immediate advantages; two or three hundred turns can be wound on and if domestic interruptions occur (a normal hazard for most of us), the winding can be stopped and resumed at a later date. Further more, if it is arranged to be reversible, those misplaced turns which have an annoying habit of cropping up, can be taken off and rewound without affecting the final count.

A survey of the junk box, the model engineer's bottom drawer, produced a sheet of 3/32 in. mild-steel sheet, 3 in. × 6 in., a phosphor bronze bush and nut with a bore of ⅜ in., probably part of an old variable condenser, from an ancient wireless set, a chunk of mild-steel which at one time had been the hex. head of a ¾-in. bolt, and finally the most important part, a Veeder type counter which at some time had been part of an electricity meter.

There seem to be two or three different types of counter available from this source, and a word or two about these may be of interest. First, the gear train type, which consists of a series of gear wheels and pinions with a ratio of ten to one, and a small pointer mounted on the end of each spindle. Quite useful results can be obtained with them, but they do suffer from the effects of backlash and can, if carelessly read, be very misleading. They are also slightly more bulky than the second type, which is the Veeder counter wheel arrangement. These are not by any means plentiful from old meters, but quite a number have come on the surplus market from such things as bombsight computors, etc. Two different final gear ratios have been observed by the writer on a number of discarded electricity meters incorporating Veeder counters, one of four to one, and the other of five to one, and each consists of a small gear wheel riveted to the first counter wheel, which is just under ¾ in. in diameter, driven by a pinion mounted on a hardened shaft of what appears to be either stainless-steel or silver-steel. The diameter is about 1/32 in. and the length is usually about 1 in. longer than the counter wheel assembly, as the shaft carries other gearing of various shapes and sizes. The hardness of these shafts was not appreciated until a small hacksaw blade was completely ruined, so the best

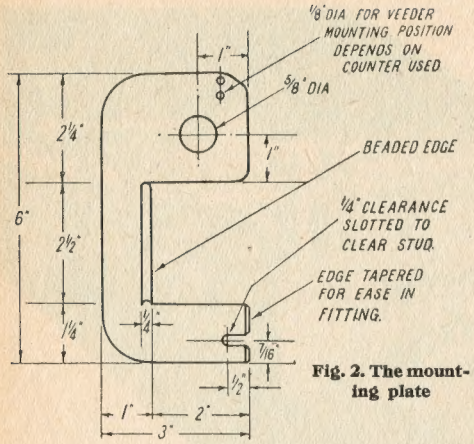


Fig. 2. The mounting plate

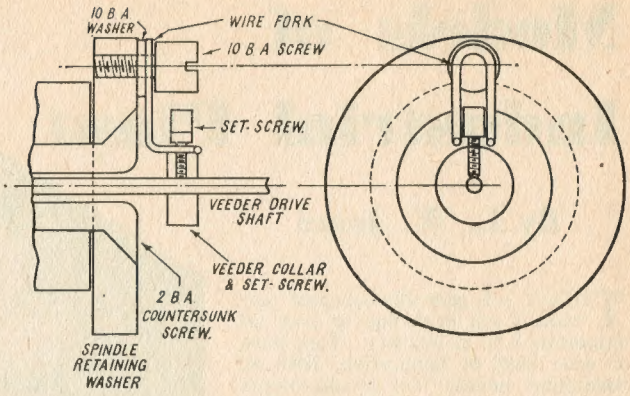


Fig. 4. The coupling to Veeder counter

way of cutting them is to rotate them against the edge of a grindstone until thin enough to snap.

The first attempt was made by removing the gearwheel from the first counter wheel and riveting on in its place a 20-tooth ratchet wheel. The idea was to operate this from two small studs on the chuck backplate, with a small lever which would, therefore, move the counter wheel one-tenth of a rev. for every turn of the lathe. This certainly worked, but had two major disadvantages. It was surprisingly noisy and the click, click, of the lever rising up and down on the studs was very irritating. No doubt this could have been overcome, but a ratchet is a one-way device, a little detail which had been overlooked, and, of course, continued to count even if turns were being removed. For these reasons, the time and energy expended in making the 20-tooth ratchet wheel(s), etc. were written off against experience, and a fresh start made.

Another Veeder counter was available, with a final gear ratio of five to one, and after some consideration it was realised, that, as a further reduction of two to one was required, it would be possible to use the 50-tooth change wheel in conjunction with the lathe mandrel pinion, which has 25 teeth. Preliminary measurements showed that the centre-line of the 50-tooth change wheel was far enough forward to enable the counter to be mounted just in front of the rear headstock bearing. It is a rather tight squeeze, but, suitably tilted, it is in a most convenient position for reading, and fairly well protected, by the headstock and belt guard, from accidental knocks and damage. The direction of rotation was also correct for the counter when winding by hand, i.e., in reverse. Should rotation in the other direction be required, it should not be difficult to insert an idler gear. This would also provide a little more room for mounting the counter, and at one period of construction it was thought that it might be necessary to do this.

No permanent alterations to the lathe were contemplated, so a method of mounting was required, using an existing tapped hole, and a convenient one was found to be the bolt towards the front of the lathe, used for holding the fixing plate of the changewheel guard in place. This was a $\frac{1}{2}$ in. $\frac{1}{4}$-B.S.F. hex. bolt, which was replaced by a short length of $\frac{1}{4}$-B.S.F. studding about $1\frac{3}{8}$ in. long, the fixing plate being held in place by a threaded spacing-collar about 1 in. in diameter and $\frac{1}{4}$ in. thick (see Fig. 1). This was an excellent and solid mounting, with a large washer and nut to clamp the gear mounting plate on.

The 6 in. by 3 in. steel plate was then cut and prepared as shown in Fig. 2. It is rather like a flattened U, the cut-out being required to clear the tumbler reverse gear lever, which it is necessary to operate, when winding layers of wire on a transformer bobbin. The $\frac{1}{4}$-in. slot, instead of just a hole, makes it easy to slip the whole gadget on or off in a matter of seconds. Instead of removing all the metal from the portion cut out, the last $\frac{1}{4}$ in. was hammered over to strengthen the weakest part on the lines of a beaded edge.

A short spindle was turned to carry the change wheel, and carefully fitted to the phosphor bronze bush (see Fig. 3). Lubrication of the spindle was another point that had to be thought of, and, even if power drive was not used, it was possible that in the future it might be. The solution, though not ideal, proved to be simple and very effective, and consisted of boring a 2-B.A. tapping hole right through the spindle, tapping 2 B.A., and drilling a radial hole $\frac{1}{16}$ in. dia. into this, at approximately the centre of the spindle bearing. The change wheel, which is fixed in position only when the counter is used, is held in place by a 2-B.A. hex. bolt, and, if a few drops of oil are dropped into the centre hole of the spindle, the action of tightening up the change wheel squeezes this oil out on to the bearing surfaces. The other end is blanked off by a screw which holds the spindle retaining washer, and which also carries the small wire fork for driving the Veeder counter.

This part of the drive was one of the biggest problems, rather akin to driving a child's go-cart with a 1,000 h.p. engine, but in fact it proved one of the simples to solve. The first idea was to make a small flexible coupling, but this

(*Continued on page* 610)

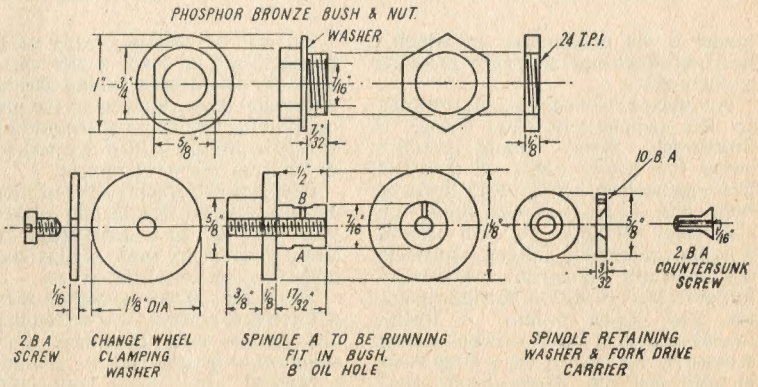
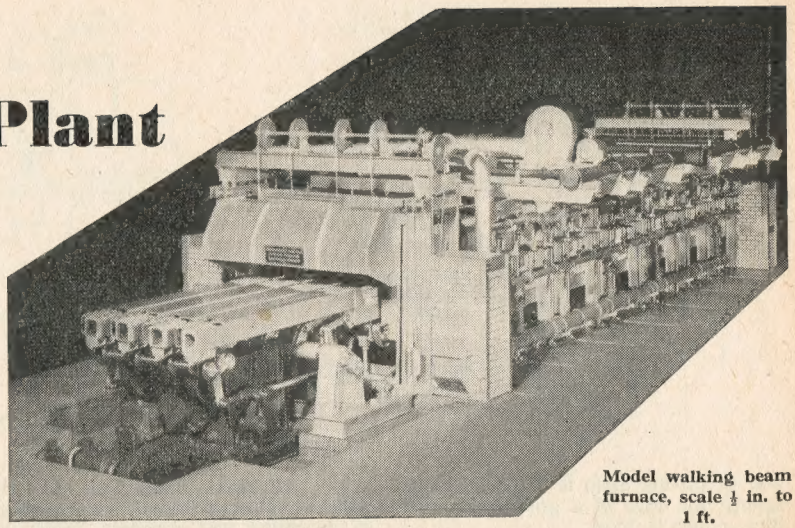


Fig. 3. Change wheel spindle and bearing

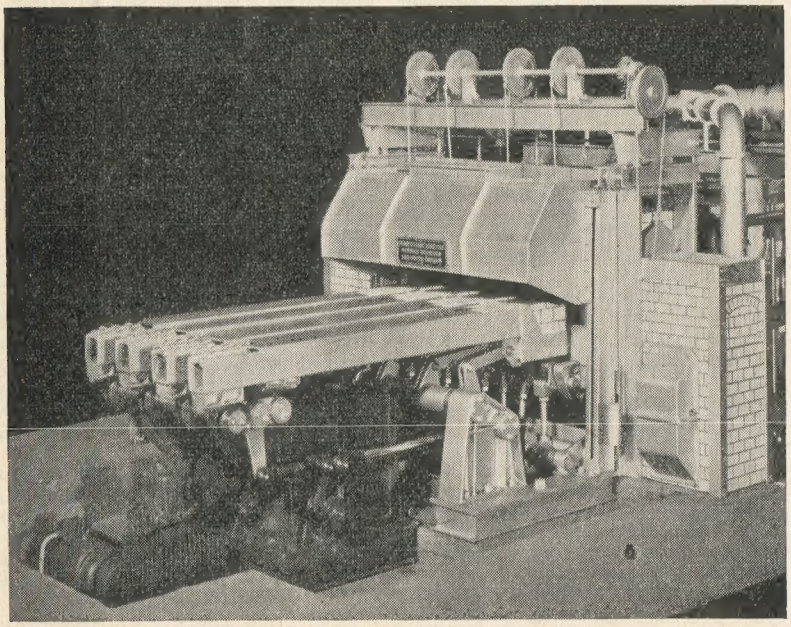
Models of Industrial Plant

By L. W. Jones



Model walking beam furnace, scale ½ in. to 1 ft.

TODAY it is generally conceded that models are beginning to play an important role in industry. They have a wide field of application, both as exhibition models and as prototypes for development purposes. In some instances, particularly in heavy industry, where the finished product may be both large and complex, built on site, or may be perhaps a " one off " job for a special purpose, the accurate scale model is the only means by which a firm's product may be readily presented to the public.



A close-up view of the power unit for the walking beam furnace

An instance of such a case is presented by the Incandescent Heat Group, of Smethwick, Staffs, whose products cover the whole range of industrial heat engineering, consisting of furnaces, both gas, oil, solid fuel fired, and electrically heated, for all trades, foundry equipment, chargers, conveyors and ancillary equipment, electric arc furnaces, H.F. electronic heating apparatus, and drying ovens. A further branch of this group's activities include a capacity for casting on a large scale, in both cast-iron, nickel-chrome steel, and " Incanite."

As will be realised, many of these products are of such a size that the scale model forms a useful means of presenting these products to the public, or, more important, to potential buyers. A further feature is their use in the field of research and development.

Realising the potentialities of models, the Incandescent Heat Group some four years ago set up a department exclusively devoted to work of this nature, under the control of the writer.

The actual model workshop may be of interest to readers. It is well equipped, and enables work of almost any description to be undertaken. It contains a Myford " M " series 3½-in. lathe, a new Harrison 5½-in. lathe, 6-in. grinder, 0-⅜-in. sensitive bench drill, 0-¼-in. Atlas compressed air drill, 5-in. Adept hand shaper, in addition to the usual small hand tools and instruments. Facilities are provided for soldering and brazing, and oxy-acetylene and sand blasting equipment are available. Incidentally, the current issue of THE MODEL ENGINEER is always found in there !

The first model illustrated is that of a walking beam furnace. This type of furnace is used for the heating of billets, and sheets, and can extend to a length of some 100 ft., with an output of 12 tons per hr.

The hearth proper consists of a number of refractory beams, supported on steel sections. These are so arranged that alternate beams move together, and the patented form of rotary and reciprocating motion is imparted to the beams from the special cylindrical cam in the motion box. This gear is so designed that at the point of change-over, both sets of beams are moving in unison, thus eliminating differential movement, and enabling the work to be progressed through the furnace without being scratched. The beams are arranged to balance each other, thus reducing the driving effort.

In the model, which is built to ½ in. = 1 ft. scale, the structural steelwork is built up of brass channel section, and the firebrick side walls are made of ⅜-in. birch plywood, with the brickwork painted on with matt poster colours, with due attention to scale and bonding.

The motion box, motor, and worm reduction gear casing are fabricated from brass tube and sheet, silver-soldered together, and motion is imparted to the beams by means of eccentric cams, driving spring loaded roller followers through the floor of the motion box. A small fractional induction motor supplies the drive to the eccentric shaft. In the model, the speed

is increased from the actual 4 strokes per min., to 20 strokes for demonstration purposes, the motion of the beams being approximate only, as eccentrics cannot reproduce the actual patent cam motion.

Pipework

In all these models, brass rod has been used for dummy pipework, as it can be bent cold, or by judicious heating to the required radii without flattening. In the case of sharp bends, or elbows, the rod is notched, heated, bent and then silver-soldered (Fig. 1).

The addition of rings of fine copper wire sweated on enhances the appearance of the screwed ends (see Fig. 1). Assembly is facilitated by screwing the pipes and bends together with the appropriate size B.A. threaded studs.

When bolted flanges are used (Fig. 2) the flanges are turned, nicked, and parted off in quantity, then indexed, drilled, and finally threaded on the stud, prior to tightening up. Large pipework assemblies are thus built up easily off the model. On the occasions when it becomes finally impossible to screw the joints together, they are provided with dowels instead of studs. These are painted with solder-paint, inserted in their respective holes, and secured with a fine blowpipe flame.

Frequent use is made of photographic reductions of large scale drawings of diagram plates, instrument and gauge dials, and instructions, with the co-operation of the works' photographer, and facsimile nameplates are photographically reproduced by printers' blockmakers, to any degree of smallness, with the co-operation of the company's publicity department.

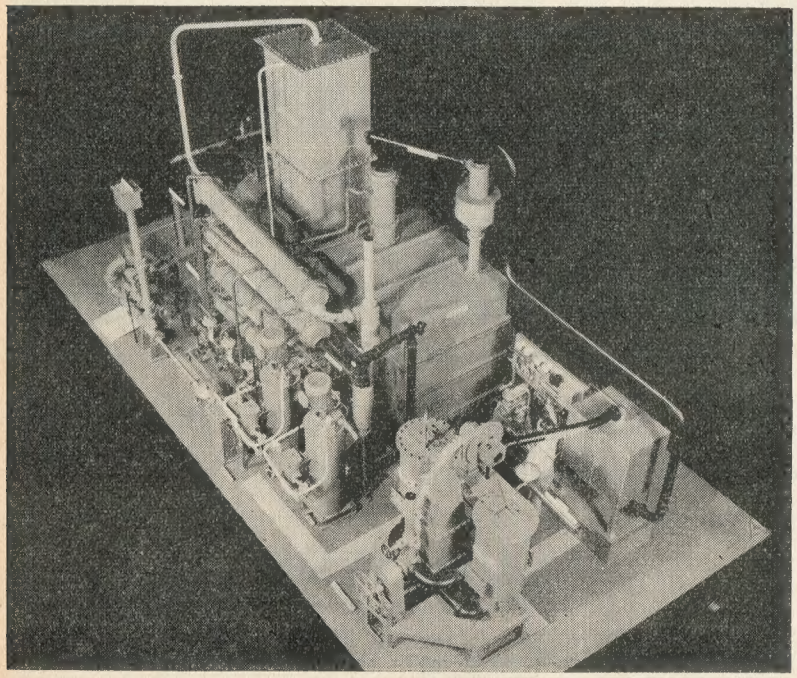
The next model illustrated is of an Incandescent Hi-Nitrogen generator.

Nitrogen is used extensively to provide a protective atmosphere for heat treatment, and chemical process. In the plant, nitrogen is extracted from the air by burning out the oxygen content, and absorbing the carbon dioxide so formed, in a solution of monoethanolamine, which has the property of releasing the absorbed carbon dioxide on boiling. Heat from the burning out of the oxygen is utilised in releasing the carbon dioxide from the amine solution, which is circulated by pumps in a continuous cycle.

The nitrogen remaining is cooled and dried, and is then ready for use. This plant is self-contained, and will provide cheaply, and at short notice, a continuous supply of nitrogen of exceptional purity.

The model, which is built to 1-in. scale, is made largely of brass, the large tanks and boiler being built up of 16-gauge brass sheet, soft soldered together and embellished with rows of 12-B.A. nuts and bolts.

Brass and copper tube was used for the various coolers, condensers, and other cylindrical parts, the supporting steelwork being of brass angle and channel sections, pipework, as usual, being of brass rod. No castings were used, all motors, booster, pumps, etc., being turned from solid bar, and fabricated with Easyflo. The small figure of the operator, seen adjusting a valve on the refrigerator was built up on a wire armature, with Barbola paste, suitably painted when dry.



Two views of a model Incandescent Hi-Nitrogen Plant, scale 1 in. to 1 ft.

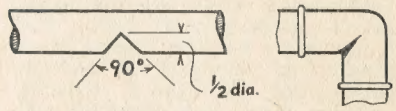


Fig. 1

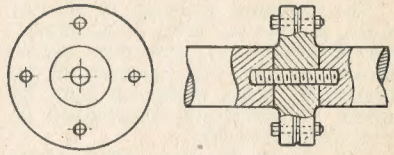
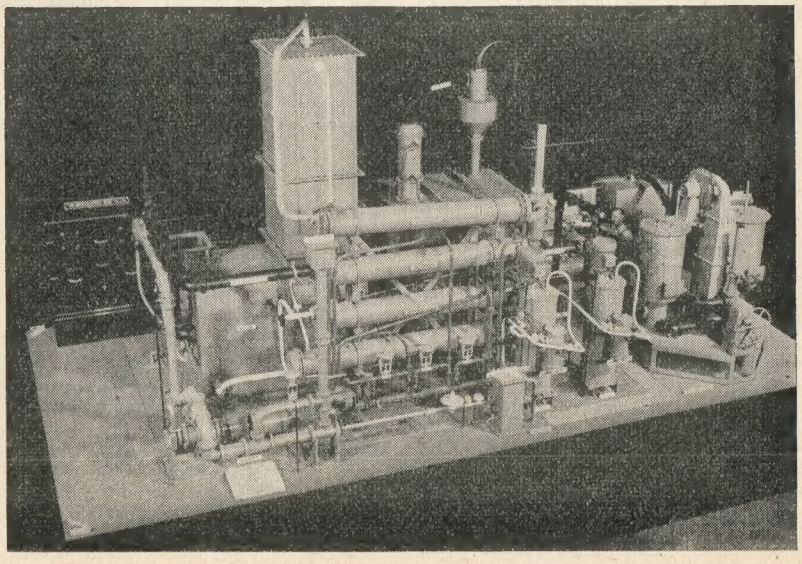


Fig. 2



The inclusion of human figures in an engineering model is open to question, but they are included on all these models, to give a comparative idea of the size of the finished plant.

The model is sprayed with battleship grey cellulose egg-shell finish, and the pipes are colour coded as follows. Air, pale blue; town gas, red; oxygen-less air, black; monoethanolamine, yellow; carbon dioxide, orange; and nitrogen, brown.

The refrigerator is finished in aluminium cellulose.

The last photograph is of a model bogie hearth furnace. This furnace is frequently used for processes, such as normalising, stress-relieving boiler drums and fabricated structures, and the annealing of large tolls. It has a capacity of 100 tons.

In this type of furnace, the refractory hearth is carried on a 12-wheeled bogie, which runs on rails into the furnace chamber. Provision is made for sealing all apertures by means of sliding doors, rollers, and sand seals, when the bogie is in position.

A feature of this type of furnace is the Laclede suspended arch roof, in which the individual refractory roof blocks are suspended and interlocked. Each block is carried by a steel-hanger from an overhead girder frame. Thus is provided a flat roof capable of expansion and contraction, of refractory construction throughout, reducing radiation losses, and dispensing with the usual arch with its loss of head-room.

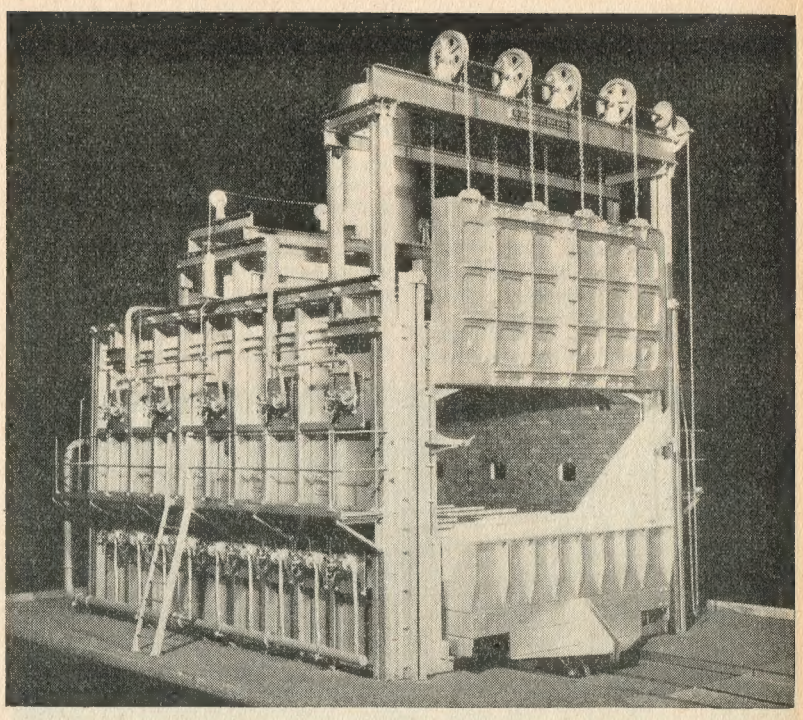
The structural steelwork of the two sides, and the two ends of the model, was first built flat, and then erected around the box-like structure of the brickwork, being pulled up tight by means of lateral and longitudinal tie rods and turnbuckles.

The model has some 500 separate units in the roof, and a small press tool was made to blank out the right- and left-handed hangers from 30-gauge brass sheet.

Twenty-eight separate oil burners were made up, all identical, each having two globe valves, pricker needle knob, nozzle, regulator, and air shutter. The bogie chassis was made of sheet brass and angle, and twelve disc type bogie wheel castings obtained from Messrs. A. J. Reeves & Co. These were turned up on a stub mandrel in the 3-jaw chuck, at one setting for each operation, thus ensuring that they were all identical.

The brickwork of the bogie was made of wood, suitably painted. The bogie runs on ¼ in. square brass bar, dull chromium plated, and glides along very smoothly.

Although some twelve models have been built so far, space permits only the brief description of three of them. At the moment, the writer is engaged in building a model of a direct arc electric steel melting furnace, complete with actual hydraulic tilting gear. The base includes the pump-room, complete with all equipment, transformer, transformer bay, and control panel cubicle. The model occupies a space 4 ft. 6 in. square, by 6 ft. high, and is built to 1½ in. = 1 ft. It is hoped that, with the editor's kind permission, it may also be described, at a later date.



Model of an Incandescent Bogie Hearth Furnace, scale ¾ in. to 1 ft.

A TURNS COUNTER

(*Continued from page* 607)

was obviously going to take up too much space, which was limited by the position of the belt guard. The solution was a small wire fork of about 32-gauge spring-steel wire, shaped to engage with the set-screw of a small collar, which was part of the original Veeder counter, and used for positioning one of the small shafts, which was fixed by means of a 10-B.A. screw to the outer edge of the spindle retaining washer. In order to conserve space, the 2-B.A. screw at this end of the spindle has a countersunk head, which is drilled with a clearance hole ($\frac{1}{16}$ in. dia.) to a depth of about ¼ in. This is of great assistance in positioning the Veeder shaft. The Veeder counter is attached to the U-plate by a small bracket adapted from one of the original bits, and it has holes with plenty of clearance, to enable its position to be easily adjusted before being firmly fixed. Fig. 4 illustrates this form of coupling on an enlarged scale.

The normal procedure is to run the lathe in a forward direction until a suitable round figure is obtained on the counter; simple arithmetic is then all that is required.

To test its reliability when running on power drive, it was fixed in position during a spell of turning, with the lathe running at top speed, and completed several hours with no signs of any trouble. Under these conditions, there was rather more noise than with the normal gear train, and it is thought that this may be due to a slight difference in the shape of the lathe mandrel pinion, and, the change wheel teeth, magnified, of course, by the somewhat slender support. No doubt this could be overcome by making a suitable 50-tooth Tufnol, or fibre gear. Quite a lightweight wheel would do, as the amount of power to be transmitted is almost negligible.

Undue importance should not be attached to the dimensions given in the sketches, as so much depends on the materials available.

This is not written as a "how to make" article, but rather as a story of success and failure which may help others to extend the usefulness of the main item of equipment in most amateur workshops.

A 10 c.c. General-purpose Four-stroke

CARBURETTOR DESIGN AND CONSTRUCTION

By

Edgar T. Westbury

TO complete the components for the engine itself, it remains only to machine the camshaft bushes, details of which are shown in the drawing at the foot of page 566 of the May 19th issue. These are made of medium bronze, and can be turned and bored at one setting from solid material. The outer bush may be a light press fit, as it is firmly secured by two screws through the timing cover into the flange, but the inner bush should be a tight press fit, as it has no other means of securing. Oil holes are drilled at an angle on the top of each flange, and the bushes may be lined up *in situ* by a reamer or D-bit passed through the assembly. Check up on the distance between the bushes so that the cam sleeve fits between them without end play.

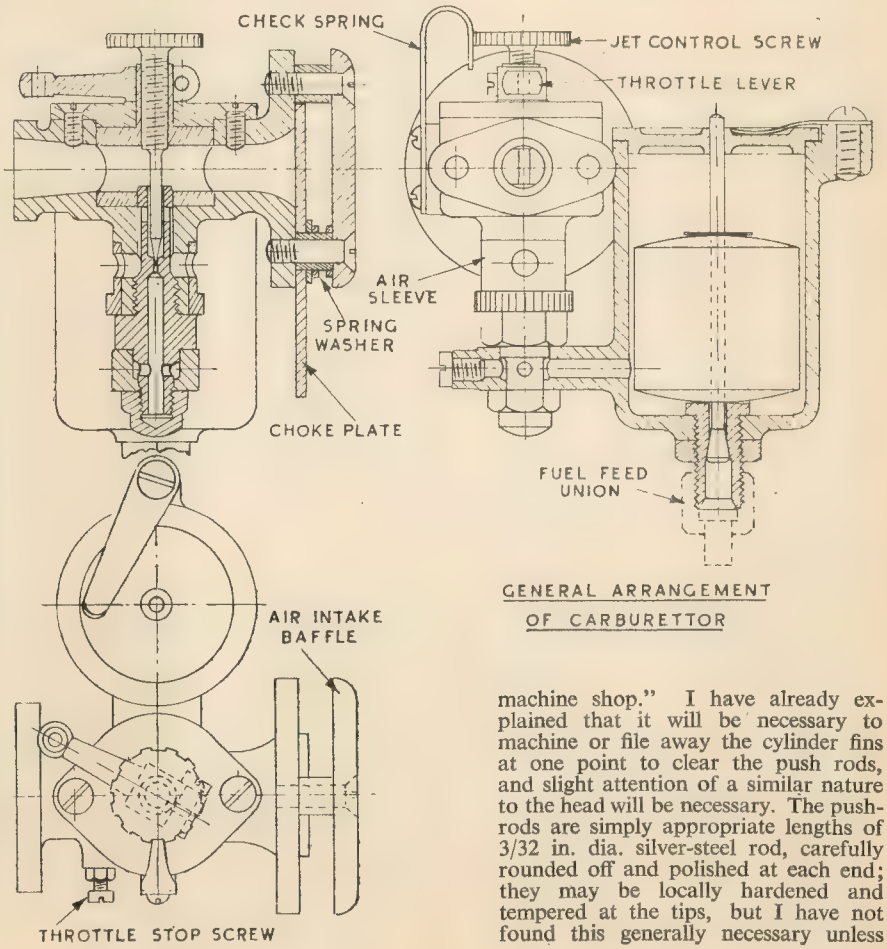
The reasons for providing a flange on the outer bush are two-fold: first, because the seating for the bush in the timing cover is not really adequate in length to ensure a secure fitting—the provision of a boss at this point is inconvenient because end space is limited—and second, because the projecting outer end of the bush forms a seating for the contact-breaker bracket, which is arranged to be capable of moving stiffly thereon, and previous experience has shown that there is a tendency for a press-fitted bush to work loose under these conditions. It will be seen from the detail drawing of the timing case (page 209 of the February 24th issue) that holes for 6-B.A. countersunk screws are provided on each side of the bush seating, and these may be spotted through into the flange to locate the tapping holes.

If the measures which have been described for locating the centre distance of the main shaft and camshaft have been observed, and the gears are accurate in all essential respects, they should mesh quite nicely and run sweetly, but slight local or general harshness may be corrected by lapping—not in their own bearings, but in the lathe, one gear mounted on a mandrel in the chuck, and the other arranged in a suitable rig on the cross-slide so as to be free to rotate, and also to move endwise; this it should do continuously throughout the process, to avoid scoring or local action. Make certain that the tips of the teeth have clearance; this should be beyond question if they are correctly cut, but I have encountered cases where it was necessary to take a skim over the tips of the teeth to get them to mesh sweetly. Serious errors in meshing *could* be compensated by fitting eccentric bushes to the camshaft, but the need should not arise if reasonable care is taken in the machining operations on the essential parts.

Continued from page 566, *May* 19, 1955.

General Assembly

It is now in order to assemble all components and prepare the engine for running in from an outside source of power, as this may be carried out while other accessory parts are being made. Very little in the way of fitting should be called for, as all the parts should go together "straight from the machine shop." I have already explained that it will be necessary to machine or file away the cylinder fins at one point to clear the push rods, and slight attention of a similar nature to the head will be necessary. The push-rods are simply appropriate lengths of 3/32 in. dia. silver-steel rod, carefully rounded off and polished at each end; they may be locally hardened and tempered at the tips, but I have not found this generally necessary unless



GENERAL ARRANGEMENT OF CARBURETTOR

the engine is required to run for very long periods without tappet adjustment. Tubular rods of light alloy with inserted hard tips, as used on larger engines, are hardly likely to show any advantage on an engine of this size.

Valve Springs

It is extremely difficult to give exact specifications of valve springs, as their physical dimensions are not necessarily an exact guide to their strength or resilience; two springs of exactly the same length, diameter, number of turns and gauge of wire may have totally different characteristics. As a general rule, however, it may be said that for this engine, springs of ⅜ in. outside diameter, having not less than six complete turns (not counting flattened end turns) of 20 S.W.G. heat-resisting spring steel, ¾ in. free length, will be found satisfactory. Do not use excessively strong springs, unless it is absolutely necessary to do so on account of valve bounce at the speeds actually employed; even so, careful investigation of cam design will often yield much better dividends, by improving the operation of the valves without increasing mechanical loading.

Carburation

If desired, any of the carburettor designs which I have described previously can be adapted to this engine; I can recommend the "Atom" Type R, which works on the principles employed in most full-sized motor car carburettors, or the "Kiwi," which has a simpler method of compensation, but both may need slight alteration in the bore dimensions. The present design, however, has been prepared specially to suit this engine, and also to conform with the demands of constructors for general simplification and avoidance of subtle factors which the inexperienced find difficult to understand.

Some instructors may be quite satisfied with the ultra-simple suction carburettor, as fitted to commercially-made two-strokes, which will work as well on this engine as on any other; but they must be prepared to accept its limitations as well as its simple virtues if they do. I am all out for simplicity when it can produce the desired results, but the fact remains that if one wishes to control an engine throughout its full range, possibly from a remote position, and to be quite sure that it will respond every time one "turns on the tap," some complication of design is absolutely necessary. As the man said when he had to make a choice between two sweethearts, "You can't have your Kate and Edith, too!"

I have provided for float feed on this carburettor, despite the advice of some of my expert friends who consider it to be unnecessary, or incapable of working properly, in small engines, because there is no other equally simple way of ensuring "constant head" feed to the jet, to ensure that mixture strength will not vary according to tank level or other variable factors. The only practical alternative to this would be a pump-feed reservoir with a spillway, which is still more complicated. Those who object to float feed may, if they so desire, omit the float chamber and feed fuel direct to the base of the jet (suitably modified) by suction or gravity; it will not affect the general control of the carburettor, apart from the variable factors mentioned above. Note that a carburettor with suction feed tends generally to be under-compensated, and, with gravity feed, over-compensated, as compared to feeding the jet exactly at zero head. The greatest practical objection to gravity feed is that it causes flooding if the engine stops with fuel turned on.

For the rest, the carburettor is simply a mechanically-compensated barrel throttle type, with a submerged jet, and a small primary air supply which can be used as a slow-running mixture control. The jet is variable, by means of a screwed needle, and it is arranged so that, after initial adjustment by hand, its opening is varied in parallel with the opening of the throttle. In this way, it is possible to keep up a high and reasonably constant air velocity at the jet at all throttle openings, and get good atomisation at all speeds, conditions which cannot both be assured when the jet opening is the same for all throttle openings. In the latter case, the choice must be made between a certain amount of restriction at full throttle and "lumpy" or erratic action at low speed; I have used such carburettors with fair success in the past, but have never been really satisfied with them. The principle employed in this carburettor is the same as that used in one I patented many years ago, and also in more recent years, in a carburettor designed for a commercially made 10 c.c. engine. It does not give compensation for load, and is thus not quite good enough to be relied upon alone, at least for full-size engines, but the submerged jet helps to make up for this deficiency; I have explained the principle of the latter in previous articles on carburation, and do not propose to go into details about it here.

Operation

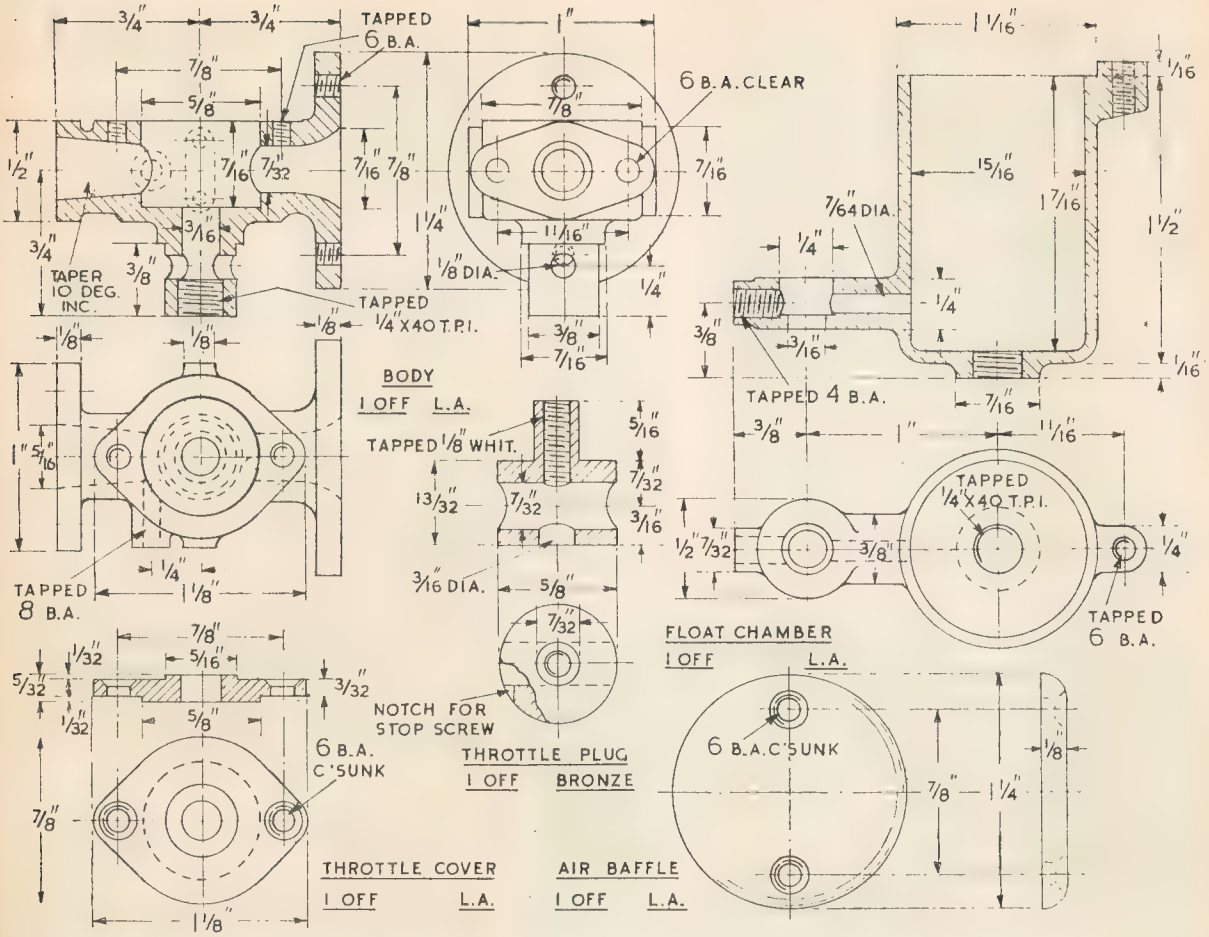
The float feed is arranged to keep the fuel level just above the orifice of the jet, where it is controlled by the tapered screw-needle, and below the cross holes in the upper part of the jet well. When air is drawn through the main air passage on the suction stroke of the engine, it causes a reduction of pressure at the top of the jet well, so that the fuel in the latter is drawn up the annular space around the needle and atomised as it mixes with the air stream. At the same time a small amount of air is drawn up the passage around the jet well, and through the cross holes; this serves the purpose of "diluting" the effect of suction, and also emulsifying and further atomising the fuel. While the barrel throttle is wide open, the maximum amount of air will pass through the throat of the air passage, and also exert the maximum effect at the actual jet orifice, though this will always be slightly less than that at the top end of the well.

When the main air passage is restricted by partially closing the throttle, the simultaneous reduction of area on both the intake and discharge edges of the barrel tends to keep the suction and velocity conditions at the centre of the barrel more or less constant, and, thus, if the size of the jet orifice were kept constant, the amount of fuel discharged would be about the same. In view of the restriction in the main air flow, however, this would result in increasing the proportion of fuel to air—in other words, an over-rich mixture; so means of reducing the discharge of fuel from the jet at small throttle openings must be provided.

It will be seen that the screwed part of the jet needle works in a tapped hole in the centre of the throttle spindle, but that the knurled head is locked (after manual adjustment) by a check spring fixed to the body. If, therefore, the throttle is moved from the full-open position by turning it in a left-handed direction, the effect of the right-hand thread on the needle will be to lower the latter into the jet orifice and reduce its area, thereby decreasing the amount of fuel discharged. The proportions of air and fuel, as required to produce an efficient combustible mixture, are influenced of course by the pitch of the thread and the angle of taper on the needle, but these are not unduly critical, as the suction at the jet orifice can be controlled to some extent by varying the flow of primary air into the well, by means of a rotatable air sleeve around the base of the carburettor body.

To isolate the carburettor to some extent from the effects of outside air flow, a flat baffle plate is fitted to the intake; the use of this fitting has long been recognised as beneficial on large carburettors, but in the present case it has the further effect of helping to stop spray entering the intake when the engine is used in a boat. It may, if desired, be replaced by an air cleaner, such as that used on the "Busy Bee" carburettor, and this would certainly be desirable for an engine intended to run for long periods in a dusty atmosphere. The provision of a flat circular flange on the intake gives an opportunity for modifying air supply arrangements in any way desired.

The provision of a strangler or choke is regarded as highly desirable in order to avoid the need for altering the jet setting when starting from cold. It is most important, if the real purpose of this design is to be fulfilled, that the jet adjustment should not be used as a running control; in fact, one might well engrave on the face of the knurled head "This knob is not for twiddling." On



second thoughts, however, this might be quite futile, human nature being what it is !

Perhaps I may be allowed to digress for a moment to relate a little anecdote which illustrates this point. In the village where I lived as a boy, there was an inn with the usual adjunct of " good stabling," and the water supply to the stables was provided by an overhead tank, fed from a well by means of a very oversize hand pump. As this was in a hunting locality, the ostlers' boy was often kept extremely busy at the hard work of manning the pump, until he hit on the bright idea of hanging a large notice on it: " Please don't touch this handle ! " And, henceforth, so it is said, all his work was done for him by the lusty lads of the village, free, gratis and for nothing !

Construction

Castings in light alloy will be available in due course for the body and float chamber, though it would not be difficult to fabricate these parts, or machine them from the solid. I always prefer to work on a good casting myself, but there are others with very different views, and any method which ultimately produces the desired result is obviously the right one; but I do object to methods which ignore the niceties of design, and produce unsightly chunks of superfluous metal in all the wrong places, because of attempts to dodge constructional problems. The fact that they may be internally correct and work satisfactorily does not, in my opinion, entirely excuse external ugliness.

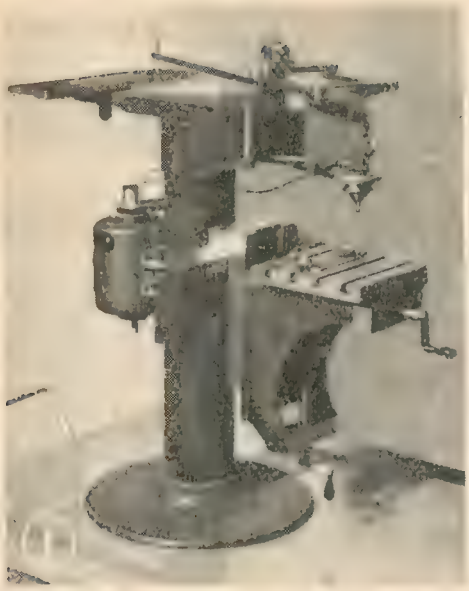
The body casting may be gripped in the three-jaw chuck, over the edge of the intake flange (assuming the latter to be reasonably clean and concentric) for facing the discharge flange, and drilling the air passage, which should be left well undersize at the present stage, but smooth enough to enable it to be mounted on a mandrel for turning and facing the intake flange. It is next chucked by the boss of the jet housing, for facing, drilling and counter-boring to take the throttle; care should be taken to machine this bore accurately, and to produce a smooth working surface for the barrel. A spigot mandrel, made a wringing fit in this bore, with a pilot $\frac{3}{16}$ in. dia. to fit the lower hole, is then used to mount the casting for machining the end face, the seating for the air sleeve, and the tapped hole for the jet, which must be perfectly concentric with the rest of the bore.

Throttle Plug

This should be made of harder material than the body, bronze or duralumin being suitable. It may be turned in one piece, and the centre-hole drilled and tapped, at one setting, before parting off, then re-chucked truly by any convenient means for facing and boring the lower end; note that this bore must be a working fit on the top of the jet tube. The fit of the plug in the body does not need to be too close, as it is not intended to be used as a plug cock to produce an airtight seal; too tight a fit may result in seizure under the " anti-lubricating " effect of petrol vapour.

It is desirable to place the plug in position in the body and scribe the bore positions on both sides, to be sure of getting them in the right location, then drill it from *both* sides with an undersize drill, prior to boring *in situ*; be careful to remove all traces of burrs from the edges of the holes.

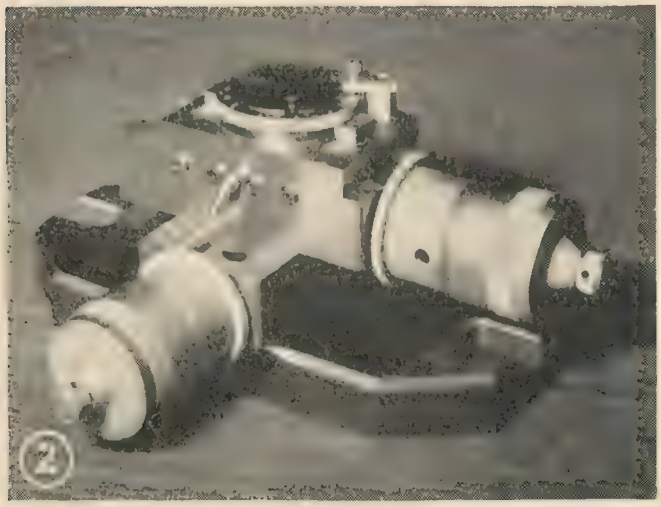
(*Continued on page* 618)



THE PHYSICAL SOCIETY'S EXHIBITION

EXAMPLES OF CRAFTSMANSHIP BY STUDENTS AND APPRENTICES

The major portion of this Exhibition, held recently at the Royal Horticultural Hall, Westminster, was devoted to exhibits of the latest developments in physical apparatus, electronics, instruments, etc., of too highly specialised a nature to come within the scope of this journal. In the section devoted to the work of apprentices and students in laboratories and other institutions associated with the above Society, however, several excellent examples of craftsmanship which will be of interest to our readers were seen, and a selection of these is illustrated herewith. The ages of constructors are: Junior Grade, under 19, Senior Grade, 19 to 22.

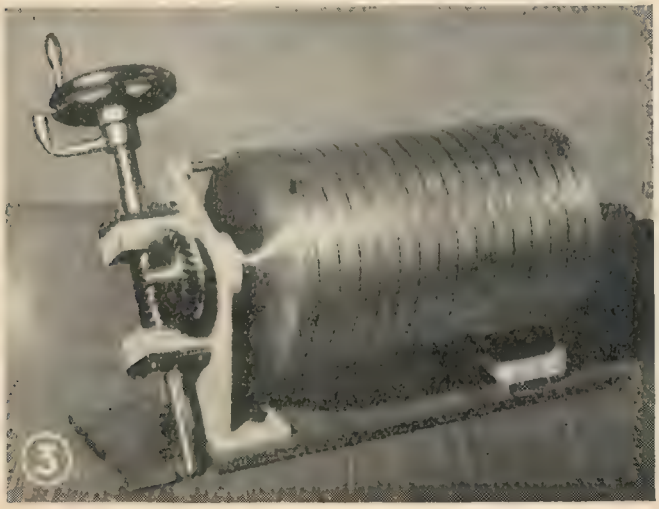


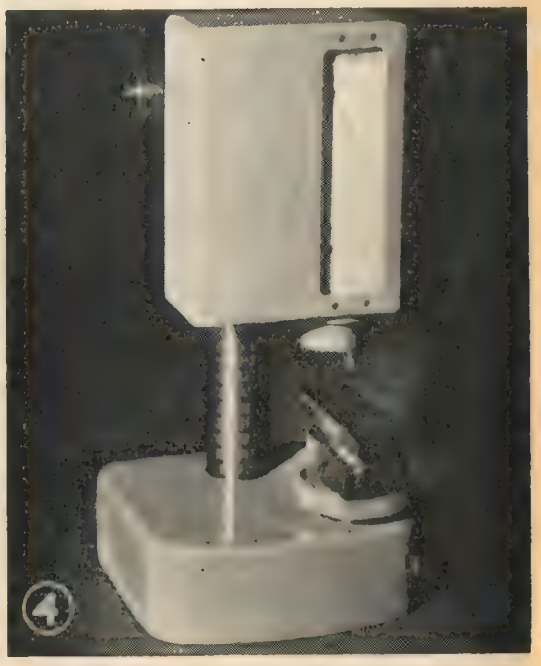
(1) Scale model pantograph engraving machine. By K. S. Ross (Standard Telephones & Cables Ltd.) (First prize, Instruments, Senior Grade)

(2) Compound dividing attachment. By J. F. Osborne (G.E.C. Research Lab.)

(3) Part unit of Mach meter control for wind tunnel. By P. M. Saunders (National Physical Laboratory)

(4) Vertical Mechanical Comparator. By B. Bygrave (S.E.R.L.) (First prize, Tools & Instruments, Senior Grade)





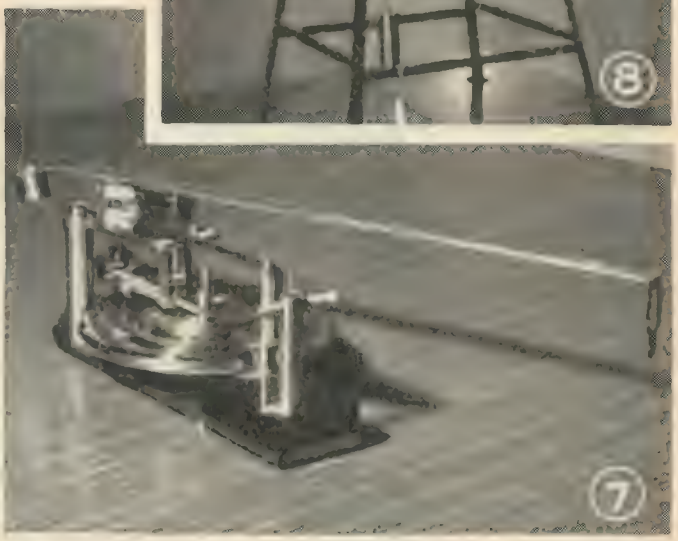
(9) Integrator Mechanism. By G. Gibbs-Murray (Elliott Bros. Ltd.) (Sylvanus P. Thompson prize)

(8) Venturi Water Meter ($\frac{1}{2}$ scale). By M. A. Spittles (Geo. Kent Ltd.) (Hon. Mention, Instruments, Junior Grade)

(7) Pressurestat Mechanism. By A. R. Banning (Northampton Polytechnic). (First prize, Instruments, Junior Grade)

(6) Six-inch circular machine table. By J. C. Donnex (S.E.R.L.) (First prize, Tools, Junior Grade)

(5) Relay for Recorder. By J. K. Batchford (Marconi Wireless & Telegraph Co. Ltd.) (Second prize, Instruments, Junior Grade)



IN THE WORKSHOP
BY DUPLEX

A Home-built Power Unit

IN the Editorial columns of this journal it was recently suggested that readers might like to submit their views on the problem of providing motive power for the workshop in the absence of an electric supply, for it appears that there is a demand for a simple and reliable type of engine by those situated in country districts not yet connected to the grid system.

We had to face this problem some years ago and, as we had had a good deal of experience of the now demoded gas engine, we naturally favoured an engine of this kind on account of its reliability and quiet running; but, at the same time, advantage was to be taken of the more modern improvements in the shape of petrol carburation, and ignition by means of a rotary magneto.

A steam-driven installation was ruled out as, unless it was fully automatic, it would require too much attention while one was engaged on mechanical work.

When the present engine, illustrated in the accompanying photographs, was on show at the Model Engineer Exhibition, it aroused much favourable comment, and some experienced workers considered that this was the best type of engine for driving and lighting the small workshop.

At the outset, a decision must be made as to whether a two-stroke engine or one of the four-stroke type is the more suitable for workshop use, for one must take into account easy starting, quiet running, and a fairly constant governed speed.

Although we have never had any trouble with two-stroke engines either on land or sea, no doubt because of proper maintenance, we know of many users of motor-cycles, lawn mowers, and marine engines who have experienced starting difficulties.

In one instance with which we were concerned, the manufacturers of a two-stroke marine engine were unable to cure the starting trouble, and this engine had to be replaced by one of the four-stroke type to obviate the recurrent danger of a dead engine in a sea-way.

After wear has taken place, the engines fitted to small lawn mowers are sometimes bad offenders in this respect, and repeated attempts to start a refractory out-board motor are no uncommon sight at the seaside. Although our views may be old-fashioned, we would plump for a four-stroke workshop engine, despite the great improvements that have been made to the two-stroke type within recent years.

A further point that has to be settled is the number of cylinders the engine is to have. However, it seems to be generally agreed that a slow-running engine for the present purpose is best made as a single-cylinder machine, for minor out-of-balance forces are of small account at the low rate of revolutions, and in a single-cylinder engine, the construction of the valve-gear and ignition system is less complicated, and the machining of the crankshaft offers less difficulty. In addition, a single-cylinder unit seems to require but little maintenance, and there is usually no difficulty in providing adequate bearings for the working parts.

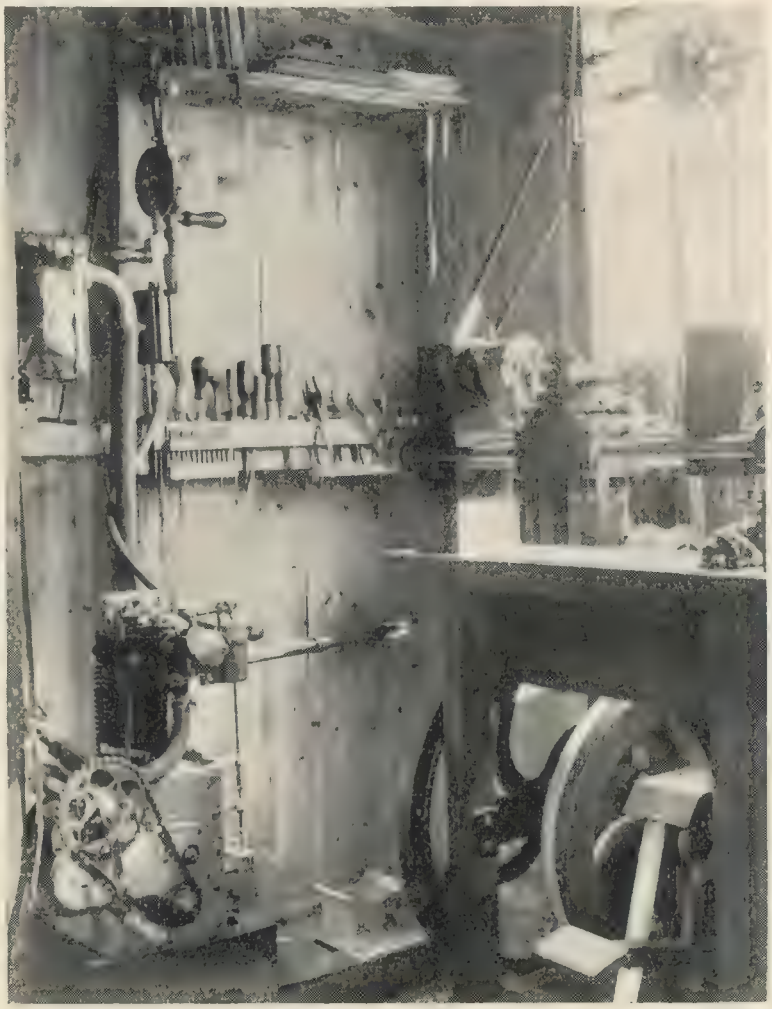


Fig. 1. The engine undergoing tests in the workshop

However, the horizontally-opposed flat-twin is a most attractive design and makes a very smooth-running engine but the construction is more complicated, and there might be some difficulty in obtaining used, standard components for the basic parts of the machine. For those who do not mind embarking on a more elaborate form of construction, the engine with three cylinders in line has many good points not shared by other types.

Before deciding on the final design, the question of whether to make the engine of the horizontal or vertical type has to be settled. The old-time horizontal gas engine with exposed working parts is not easily forgotten by those who can recall seeing these beautifully-finished engines run-

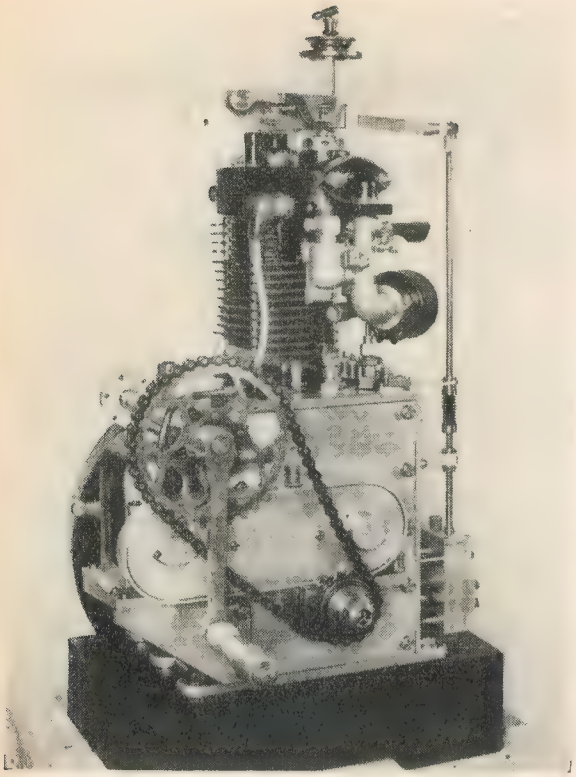


Fig. 2. Showing the starting gear and the induction system

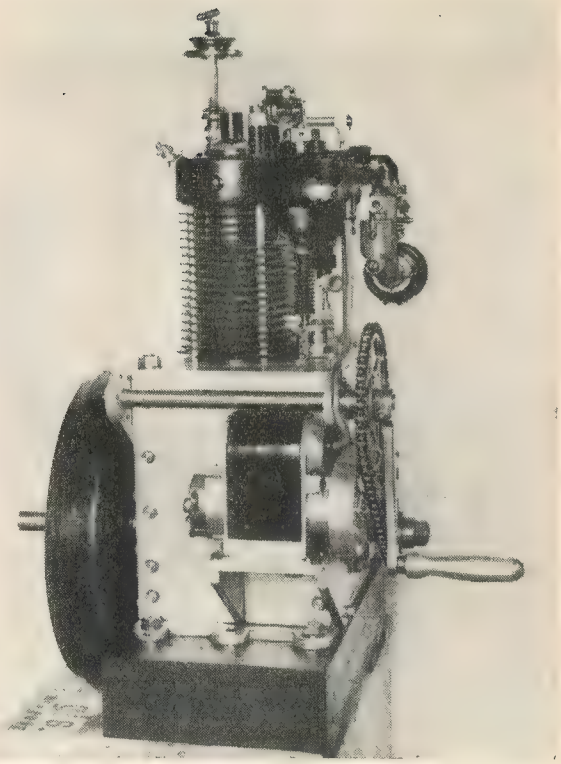


Fig. 3. Showing the magneto mounting and heavy car-type flywheel

ning almost silently in shop windows and show rooms, but this type has the disadvantages that it occupies much floor-space for the power developed, and the heavy trunk-piston is apt to cause pronounced cylinder wear on the lower side of the bore. On the other hand, the vertical type of engine is more compact, and takes up little room in the workshop; moreover, the working parts of these engines can readily be enclosed and so kept free from dust, and their lubrication is easily arranged without giving rise to splashing.

The Final Design

It so happened that, some years previously, we had bought a 1901 2¾ h.p., single-cylinder, de Dion engine that had formerly been the power unit of a de Dion "quad." Although we used to see one of these machines, from time to time, on the road, we were more familiar about 1896 with the earlier de Dion tricycle, owned and ridden by the local cycle agent. This machine was fitted with tube ignition, heated by means of a built-in petrol blow-lamp, and once the machine was under way, this seemed quite reliable, although noisy and, of course, inefficient.

When building the workshop engine, some of the original components seemed to be well fitted for inclusion, for the cylinder had a detachable water-cooled head and the cylinder and piston, as well as the half-time gear and valves, showed no signs of wear. However, the crankshaft bearings seemed too small, and the connecting-rod too short for an engine of the stationary type, so these parts were discarded and a new crankcase, fitted with ball-bearings, was designed. In the cylinder-head, the automatic inlet valve was in accordance with contemporary practice, and although we used this type of valve in both cars and cycles for some years, they never gave any trouble, except for an occasional broken or softened spring. The reason for this is, of course, that in those early days petrol engines ran at quite low speeds, and valve bounce and hammering of the seatings were not then a problem; moreover, the light springs that were adequate for closing the exhaust valves imposed but little loading on the half-time gear, and thus reduced wear. The top speed of these engines was commonly controlled by a governor, which could be cut out by depressing the accelerator pedal to allow the main throttle to take charge. For a workshop engine, a low speed is a great advantage in preventing noise and increasing reliability, as well as prolonging the intervals between overhauls. A low compression ratio and a heavy flywheel will make for easy starting and smooth running with but little fluctuation of speed. The fitting of ball- and roller-bearings to the crankshaft and big-end also minimises any difficulty there may be in lubricating these parts.

Good Qualities

The engine described drove the machine tools, and also a dynamo for lighting the workshop, for a period of ten years and, during that time, no maintenance work, apart from cleaning the sparking-plug, was required, and the cylinder-head did not need decarbonising; nevertheless, the compression did not deteriorate and starting was always immediate. These good qualities were, no doubt, due in part to the slow speed of some 500 r.p.m. to 700 r.p.m. for which the engine was designed, and even at these revolutions a motor-cycle type of engine of 3 nominal h.p. should give a useful output not far short of 1 h.p. However, it will now be hardly possible to obtain engine parts of the kind we used, but there should be no great difficulty in finding a discarded motor-cycle engine cylinder and other parts capable of being reconditioned.

If there is a sufficient demand, some commercial firm might, perhaps, supply a casting of a water-cooled head that could be machined to fit some of the standard makes of motor-cycle cylinders, and the adoption of an automatic inlet-valve with a detachable seating would

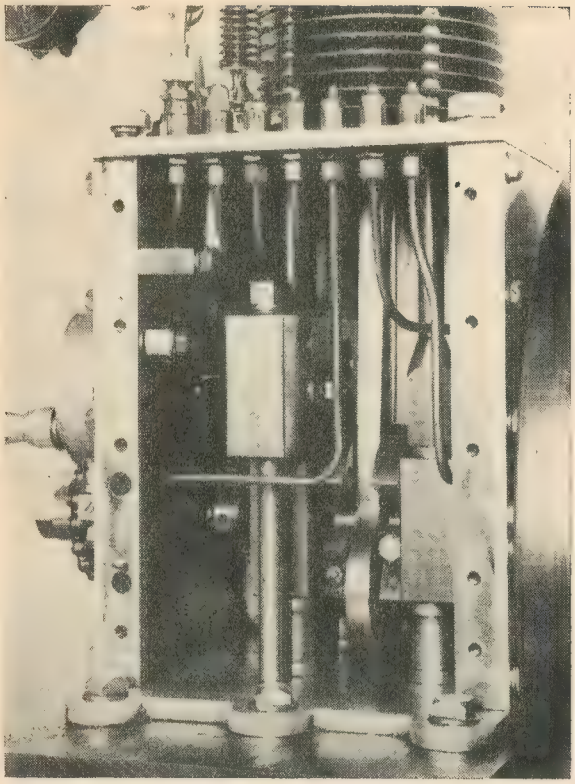


Fig. 4. Interior view of the crankcase with the cover removed

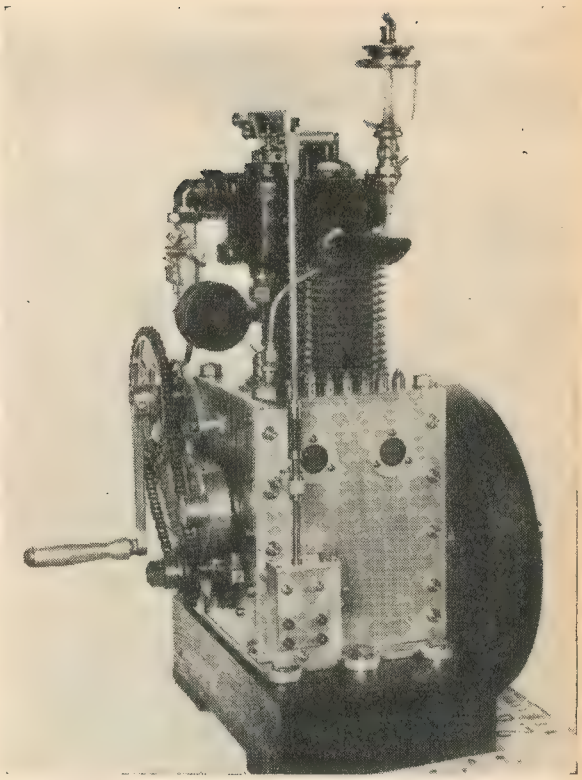


Fig. 5. Showing the hydraulic governor controlling the lift of the automatic inlet valve

simplify the valve mechanism as well as the machining needed. We hope to describe the essential features only of the design and construction of the engine, for the actual details will have to be modified in accordance with the design and dimensions of the parts used for the main components of the engine.

(*To be continued*)

A 10-c.c. GENERAL-PURPOSE FOUR-STROKE

(*Continued from page* 613)

Throttle Cover

This may be made either from a casting or a slice off a light alloy bar, and the underside should be faced and spigoted to fit the throttle bore, with a concentric hole to fit the stem of the plug. It may then be wrung on to a shouldered mandrel to face the top side, leaving a slightly raised centre boss. Drill the screw holes, and use the cover as a jig to drill and tap the holes in the body.

The throttle plug is now inserted, and held in place by screwing down the cover, interposing a paper washer so that the plug is firmly clamped, with its cross hole coinciding with the main passage bore. With the intake flange of the casting gripped in the inside jaws of the chuck, the passage may now be bored right through to finished size, and tapered at the discharge end to an included angle of 10 deg., to produce a diameter of $\frac{5}{16}$ in. at the mouth. The flare at the intake end may be produced by mounting the casting on a tapered mandrel, and using a hand tool to form a sweeping curve, $\frac{7}{16}$ in. dia. at the mouth.

Float Chamber

The casting is simple to machine, being held in the three-jaw chuck, top outwards, for facing the edge and cleaning out the inside surface, also drilling and tapping the hole in the base, the underside of which is then faced by reversing in the chuck and bedding the top edge firmly against the chuck face, with the stepped lug projecting into one of the jaw slots. Alternatively, a plug mandrel may be used to mount the casting for this small, but essential operation.

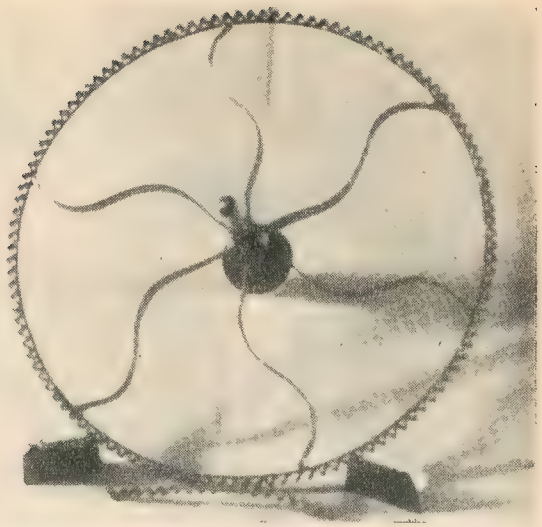
For the hole to fit the base of the jet tube, it is desirable to set up the casting eccentrically, top outwards, in the four-jaw chuck or on the face plate. The boss of the projection may then be faced, centre-drilled, drilled and counterbored. If a back facing cutter is available which can be inserted from the hollow mandrel of the lathe, it is possible to avoid the need for a further set-up to face the underside of this boss, which must obviously be quite parallel with the top. Another method of dealing with this job is to mount the float chamber by its bore on a plug mandrel, and face the two sides of the boss with right- and left-hand side tools, either before or after drilling and counterboring the hole.

The horizontal passage may be drilled either in the lathe or drilling machine, the outer end being spot faced and tapped to take a plug screw, which may be made either a permanent blind closure or removable for cleaning purposes.

(*To be continued*)

Never at a Loss!

THE TALE OF A BACKWOODS ENGINEERING PROBLEM



A photograph of the finished gear-wheel

THE word "impossible" does not exist in the vocabulary of the engineer; there is no limit to his resourcefulness, and to him the toughest problem is but a challenge to his ingenuity. On many occasions we have told of the way readers, faced with apparently insuperable difficulties, have surmounted them by patience and determination, often aided by only the most primitive and inadequate equipment.

Some years ago, the story was told in these pages of how spectacles were manufactured in a Japanese prisoner of war camp, with improvised tools, and material obtained from broken bottles. Within the last few months, we have heard an equally remarkable story of a redoubtable Yorkshireman who, having broken his dentures and faced with delay in replacement, made a mould in garden soil, melted some iron in the kitchen range, and cast himself a new set!

A comparable achievement has recently been brought to our notice by a reader in British Columbia, who apparently does not wish his name to appear, but offers the choice of two *noms de plume*, "$\frac{5}{8}$ fitter," and "Geordy."

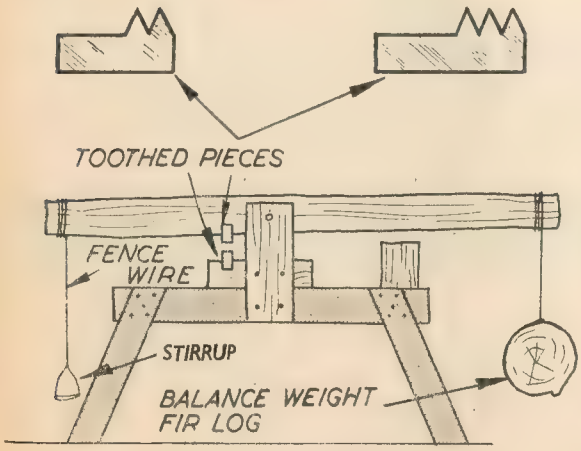
In a long and amusing letter, he describes how, while on a fishing trip in the "tall timber," 25 miles from the nearest town, a friend (who, incidentally, possessed a fairly well equipped workshop at home) confronted him with a problem in the construction of a mechanism, which included making a light but reasonably accurate 120-toothed gear wheel. Here he comments that his friend is less than half his age—64 years—and has not had a lifetime of mechanical experience—nor has he "read as many copies of Ours as I have!" The suggestion—perhaps a little up-stage—that perhaps an old-timer could do wonders even out in the backwoods set him thinking seriously over the problem, and eventually to get down to work on it, with no other material than that obtained from tin cans and other camp junk, and no tools beyond a 6-foot timber saw, a worn-out three-square saw file, a poker (pressed into service as a soldering-bit), a hammer and nails—the latter being used both as tools and materials.

Inspiration for the method of producing the teeth of the gear was obtained from a piece of corrugated packing paper which had been wrapped round a glass lamp chimney, and the means of forming the teeth—from $\frac{3}{16}$-in. strips of tin off a pork and beans tin—were ingeniously contrived in the form of a primitive foot-operated lever press. This was improvised from an old "saw horse" (to the uninitiated, a trestle used for sawing logs), various odd bits of driftwood, and a pair of forming tools or dies filed up from the broken tang of an old scythe.

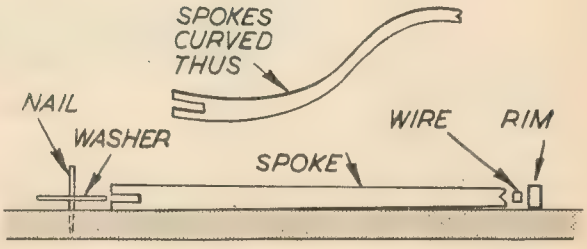
After forming a sufficient number of strips to produce 120 teeth, they were soldered around a rim of fencing wire to produce a ring of the required diameter. The six curved spokes were made from heavier gauge sheet metal from a cookie tray, each bent in a double curve, soldered at the outer end to the rim, and at the inner end to a washer which served as the hub.

To true up the wheel, a rig similar to that used by cycle mechanics was contrived, and, after some coaxing, the wheel was finished as shown in the photograph, which also includes a spare toothed segment and the "dies" used for forming the teeth. The job, says "Geordy," whiled away a few idle hours, and his friend, who had watched in subdued silence, smoking "lots of matches," appeared duly impressed.

And so were we!



The improvised foot-operated forming press



Method of assembling the rim and spokes on the hub

L.B.S.C.'s "Netta"

REGULATOR AND SUPERHEATER FOR THE $3\frac{1}{2}$-in. GAUGE ENGINE

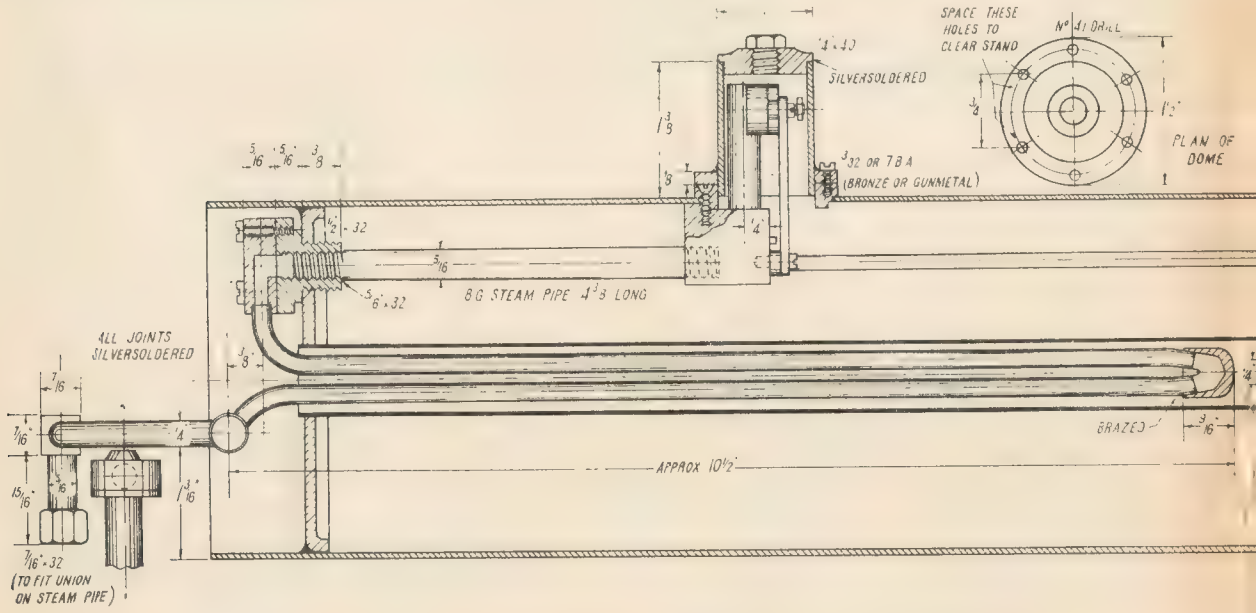
JUST one glance at the accompanying illustrations will show that while the principle of the superheater for the $3\frac{1}{2}$-in. gauge *Netta* is the same as that of the middle quin, the construction differs considerably; and an entirely different pattern of regulator is specified. The superheater has three elements, but a separate "wet" header is dispensed with, by the simple expedient of connecting all three to the steam flange direct. The "hot" ends of the elements are connected to a header made from tube; and two pipes convey steam from this to a junction block on top of a short vertical pipe, with a union for coupling to the steam pipe leading to the cylinders. This arrangement dodges the blast nozzle and the blower pipe, as shown in the plan and elevation views, and the whole bag of tricks is easy to make and erect. As to the regulator, this is of the well-tried Stroudley pattern, but has the stand pipe made from a piece of tube, as in full-size practice, and allows the steamway in the base block to be drilled at an angle, to meet the main steam pipe; this, in turn, gives plenty of room for the bearing hole which carries the end of the regulator-rod, to be drilled without any fear of it piercing the steam passage. No large hole being needed in the backhead, the gland fitting can be made small and neat; either the type of handle shown, or any other type as preferred, can be fitted.

Built-up Regulator Stand

The base of the stand is a block of brass, $\frac{7}{8}$ in. square and $\frac{7}{16}$ in. thick. One edge of this is milled, or carefully filed away, to a depth of approximately $\frac{1}{16}$ in. (just sufficient to clear the underside of the dome bush, where it projects inside the boiler barrel) for a distance of $\frac{5}{8}$ in., the remaining $\frac{1}{4}$ in. being filed to a slight curve, to fit nicely against the inside of the boiler barrel. This is shown in the back view. At $\frac{1}{4}$ in. from the edge of the "step," drill a hole a full $\frac{1}{8}$ in. deep with a 19/64-in. drill. On the larger end of the block, at $\frac{5}{8}$ in. below the top of the raised portion, drill a hole $\frac{5}{16}$ in. deep with letter *J* or 9/32-in. drill, and tap it $\frac{5}{16}$ in. × 32. Exactly opposite this, on the centre-line of the other end, drill a No. 30 hole $\frac{3}{16}$ in. deep.

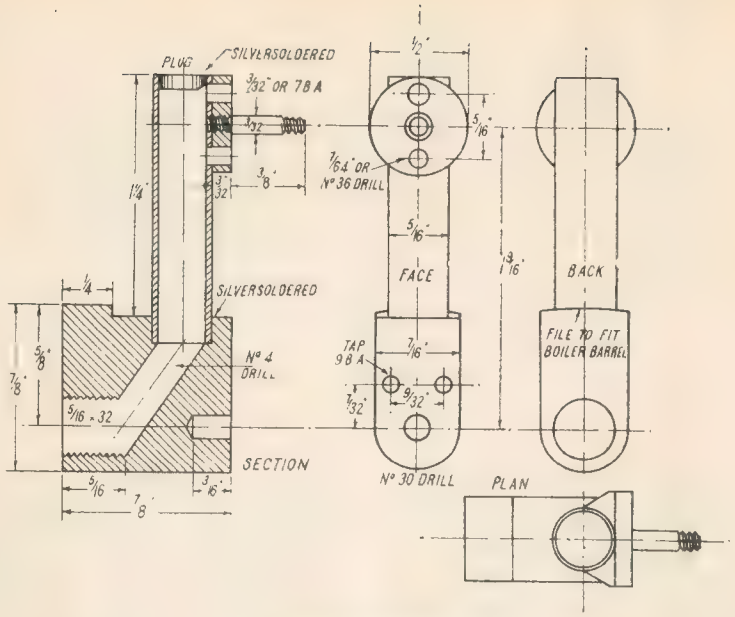
The stand-pipe is a piece of $\frac{5}{16}$-in. copper tube squared off in the lathe to a length of $1\frac{3}{8}$ in. One end of this is reduced just enough to allow it to be driven tightly into the block. Before driving it in, drill the communicating hole shown in the section, which allows steam to pass from the stand-pipe to the main steam pipe, with either No. 4 or 7/32-in. drill. I usually drill these slanting holes by holding the work in a machine-vice on the drilling-machine table, at such an angle that the slanting hole will be vertical (says Pat) and "sight" the drill on the outside of the work. Anyway, the exact angle doesn't matter a bean, as long as the drill breaks into the tapped hole for its full diameter. The stand-pipe can then be squeezed in, and a brass plug about 3/32 in. thick, driven into the open end.

The portface section is a short piece of $\frac{1}{2}$-in. round bronze or gunmetal rod, recessed at the back, to fit closely against the stand-pipe. This can be made to fit the pipe exactly, in the following simple way. At $\frac{5}{16}$ in. from the end of a short piece of $\frac{1}{2}$-in. rod, drill a cross-hole with 19/64-in. drill, and ream it $\frac{5}{16}$ in. Chuck in three-jaw, and



Regulator and superheater for the $3\frac{1}{2}$-in gauge engine

face off the end until within 3/32 in. of the cross-hole. Centre, and drill into the cross-hole with No. 48 drill, countersinking slightly. Now saw the piece right across the centre of the cross-hole, and there is your port block, only needing the sides bevelling off with a file, as shown in plan, before silver-soldering it to the stand-pipe. Tie it in position with a bit of thin iron binding-wire, level with the top of the pipe, and then silver-solder the whole doings, base block, port block, stand-pipe and plug, at one heat, using best-grade solder, or Easyflo. Pickle, wash, and clean up; put the No. 48 drill through the hole in the portface, right through the wall of the stand-pipe, tap it 3/32 in. or 7 B.A. for the trunnion pin, and set out and drill the two steam ports as shown. The drill will automatically cut the little clearance in the plug, when the top hole is drilled. True up the portface in the same way as I always recommend, by rubbing on a bit of abrasive cloth laid on something flat, fit a pin made from 3/32-in. bronze or brass rod, screwed as shown, and round off the bottom of the block—or not, just as you fancy ! It makes no difference to the operation of the regulator.

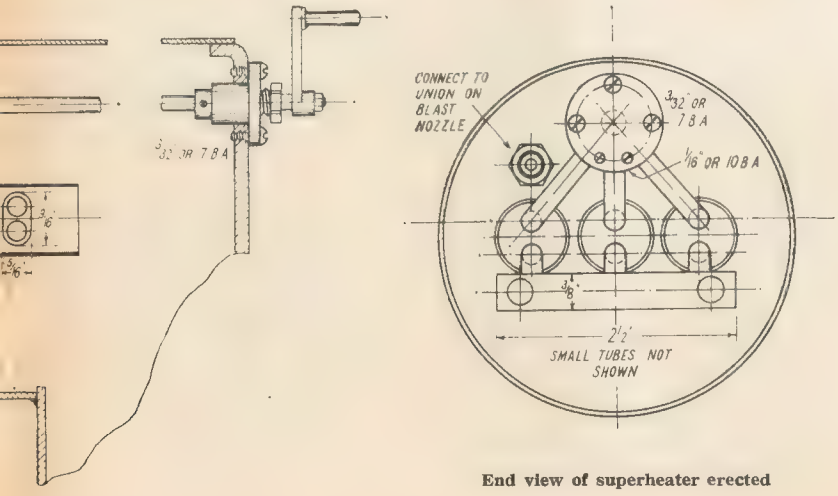


Regulator stand

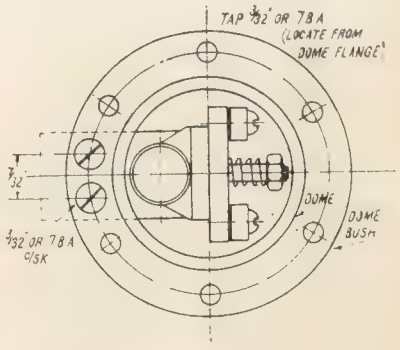
Details, Assembly and Erection

The rest of the job is all plain sailing, needing no fully-detailed instructions. The valve is filed up from a slice of $\frac{3}{4}$-in. bronze or gunmetal rod; face it truly in the chuck, and drill and countersink the hole for the pin, before parting off to a full 3/32 in. thick. The double-armed lever is filed up from a piece of $\frac{1}{8}$-in. × $\frac{5}{16}$-in. flat brass rod; the hole in the middle is first drilled No. 32 and then either punched or filed square. I make my square punches from short lengths of silver-steel of the required section, merely grinding the ends dead square, and hardening and tempering to dark yellow. The end which you " 'it wiv an 'ammer " (says Bert Smiff) is slightly tapered off, so that the punch can be knocked clean through, and doesn't need pulling out. The two links are made from 3/32-in. × $\frac{3}{16}$-in. strip (brass or bronze) or cut from 13-gauge sheet. The assembly is shown in a separate illustration; and before assembling, don't forget to perform the true-face act on the valve, as before described. Smear with cylinder oil before putting the valve in place.

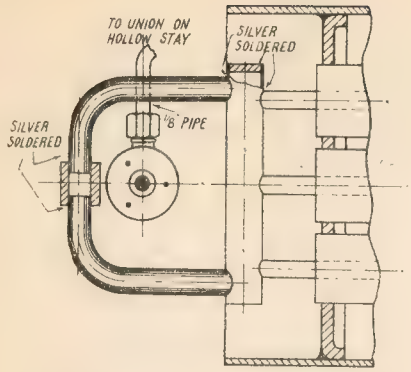
Now here is a tip: *don't* use commercial brass screws for assembly; make your own, from 5/32-in. drawn bronze rod. Chuck in three-jaw, and turn down about 7/32 in. length, to 3/32 in. dia., to fit the holes in the links without shake. Put a link on, then run the die right up to the link, which will leave the exact amount of " plain " required under the head. Part off at $\frac{1}{8}$ in. from shoulder, reverse in chuck, round off the head with a file (cheese-heads would foul the dome cover; see plan showing regulator erected) and slot with a fine hacksaw. Note, the threads *must be tight*; you've only 3/32 in. depth of thread in the lugs of the valve, but that is ample if the threads are tight, it is equal to $1\frac{1}{2}$ in. on a full-size engine. The screws must not project through the valve, but must be flush with the working face. When making a similar regulator for my L.B. & S.C.R. *Grosvenor*, I gave the valve face a final rub on the emerycloth laid on my surfaceplate, after attaching the links. That



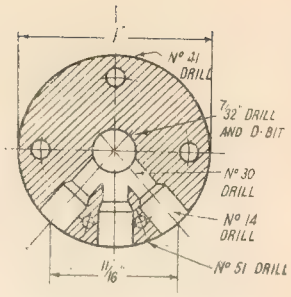
End view of superheater erected



Plan of regulator erected



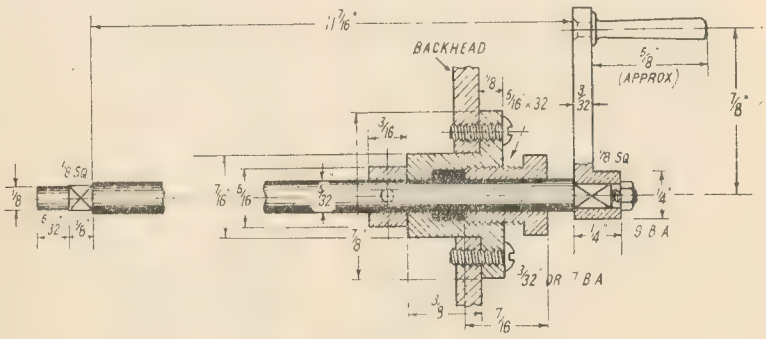
Plan of superheater connections



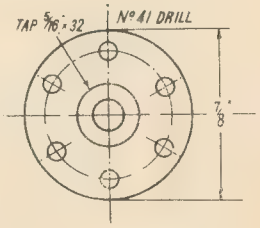
Section of superheater flange

was some years ago, and it hasn't leaked yet, nor shown any signs of coming adrift. Stop pins, made from stubs of 15-gauge brass wire screwed 9 B.A. can be fitted as shown.

To erect the regulator, first drill two No. 41 holes 7/32 in. apart, in the dome bush, as shown by the screwheads in the plan of the regulator erected, and countersink them. Now put the regulator in position; it will go through the hole in the bush easily enough, if the links are temporarily removed (no need to disconnect them from the lever). Hold it in the position shown, with the stand-pipe a full $\frac{1}{16}$ in. clear of the side of the hole; this is to allow for the thickness of the dome, see longitudinal section. To make certain that the block lines up "fore-and-aft," as our nautical friends would say, it is a good wheeze to put a few $\frac{5}{16}$-in. × 32 threads on the end of a bit of $\frac{5}{16}$-in. pipe or rod, poke same through the hole in the smokebox tubeplate, and screw it lightly into the steam-pipe hole in the block. Now, with the block held up tightly against the boiler barrel, put the No. 41 drill down the holes in the dome bush, and make countersinks in the top of the block. Remove regulator, drill the countersinks No. 48, and tap 3/32 in. or 7 B.A. The regulator can then be replaced, and fixed with two countersunk screws, preferably home-made from bronze rod, similar to those previously described; the commercial "brass" screws of today are prone to rot and break when used in boiler work, though they seem O.K. for radio work, electrical fittings, etc., where there is neither heat nor moisture. The links can then be replaced, with the lever hanging from them inside the boiler. The square hole should line up with the round one in the block.



Regulator gland fitting and rod

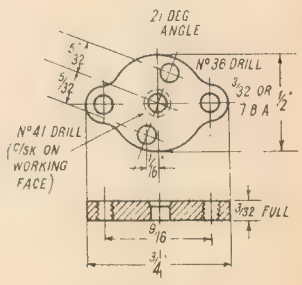


Regulator flange

Cut a piece of $\frac{5}{16}$-in. × 18-gauge copper pipe to a length of $4\frac{3}{8}$ in. and screw each end as shown. Anoint threads with plumbers' jointing, insert the shorter screwed end through the hole in smokebox tubeplate, and screw home into the block; I do this by putting the end of a round file into the tube, which releases itself when turned backwards, but some folk would rather slot the end of the tube for a screwdriver. Then make a flange fitting with internal and external threads, same as described for the $2\frac{1}{2}$ in. job, but working to dimensions shown; either a casting, or 1-in. round rod can be used. Screw home against the tubeplate as shown, and don't forget an application of the plumbers' antileak.

Regulator Operating Gear

The flanged stuffing-box and gland are made up exactly as described last week, but to the given dimensions. The regulator-rod is a piece of 5/32-in. round rustless steel or drawn bronze rod (phosphor or nickel) approximately $12\frac{1}{8}$ in. long. One end is turned down to $\frac{1}{8}$ in. dia. for 5/32 in. length, and the next $\frac{1}{8}$ in. is filed square, to fit the square hole in the double-armed lever. The other end is turned down for 5/32 in. to 5/64 in. dia. and screwed 9 B.A. the next $\frac{3}{16}$ in. being squared to fit the regulator handle boss, which is drilled No. 32 and punched or filed square, same as the hole in the lever. The collar is a slice of $\frac{5}{16}$-in. round brass rod a full $\frac{3}{16}$ in. long, with a No. 23 hole through it. Press it temporarily on the rod at $\frac{7}{8}$ in. from the square at the handle end, and push the end through the boss of the backhead fitting; then poke the long rod through the hole in the backhead, and wangle the end of it through the double-armed lever, so that the spigot enters the hole in block. This is easier than it sounds, if you use a bit of wire with a hook on the end, put down the dome bush; catch the rod in it, and guide the end through the hole in the double-armed lever. Maybe not as exciting as fishing off the end of the pier, but more certain of a catch, and no bait needed on the hook! Press the flange tightly against the backhead, and see how much end-play you have; there should be between 1/64 in. and 1/32 in. If more, or if none at all, adjust the collar. When O.K. pin the collar to the rod, as described last week; the lot can then be fitted "for keeps," the flange being fixed to the backhead by round-head screws, with

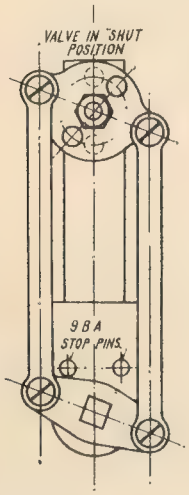


Regulator valve

a 1/64-in. Hallite or similar gasket between flange and backhead. Pack the gland with a few strands of graphited yarn, put on what Bert Smiff calls the "'Arry Randall," and another job's done.

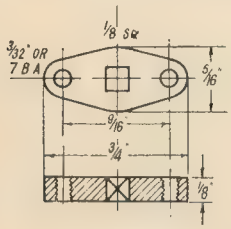
Dome

The dome may be turned from a casting, or built up. If the former, bore



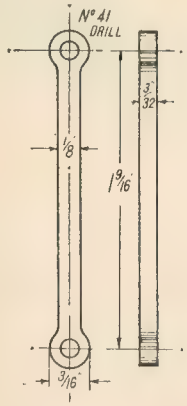
How to assemble the regulator

the inside to a full $\frac{7}{8}$ in. dia., or it won't fit over the regulator. To build up, square off a piece of 1-in. × 18-gauge copper tube to a length of $1\frac{3}{8}$ in. and turn a cap to fit, as shown in section, from 1-in. round rod, drilling and tapping a $\frac{1}{4}$-in. × 40 hole in what my youngest friend calls the "miggel." The flange can either be a $\frac{1}{8}$ in. slice parted off a piece of $1\frac{1}{2}$ in. round rod, or cut from $\frac{1}{8}$-in. brass plate; if the latter, saw it roughly to size, solder it to the end of a stub of brass rod, which can be held in the chuck whilst the edge is turned to $1\frac{1}{2}$ in. dia. in the same way



Regulator lever

as a smokebox door. Melt off the stub, chuck by rim, and bore out to a tight fit on the tube. Set out and drill the screwholes as shown, squeeze it on to the tube at $\frac{1}{8}$ in. from the open end, and silver-solder both flange and cap, applying the solder above the contact side. If any seeps through, chuck in three-jaw, flange outward, and skim it off with a knife tool. Attach the finished job to the boiler bush by six screws located as shown, to clear the screws holding the regulator in place, and putting a 1/64-in. gasket between the flanges. The screwed plug at the top, can be turned from $\frac{5}{16}$-in. hexagon brass



Regulator links

rod. A cast dome should be attached in similar fashion. The outer cover need not be fitted until the engine has been on test.

Superheater

The three elements are made up in exactly the same way as the single element described last week, but to the length shown in the accompanying illustrations. The upper flange, or "wet" header, is also similar, but made up from 1 in. dia. material, either cast or drawn, a piece $\frac{5}{16}$ in. full thickness being needed. Chuck in three-jaw, face, centre, and drill 7/32 in. for about $\frac{1}{8}$ in. depth, finishing with a 7/32-in. D-bit to a depth of $\frac{1}{4}$ in. so that there is $\frac{1}{16}$ in. of solid metal left. Drill three No. 30 holes at the angle shown, breaking into the centre one, and open out the ends of these with No. 14 drill, to take the upper ends of the elements. Be careful when drilling the screwholes. I have shown a section of the flange, to make everything quite clear.

The "hot" header is a $2\frac{1}{2}$-in. length of $\frac{3}{8}$-in. copper tube (an offcut of boiler tube does fine) with a $\frac{1}{16}$-in. plug in each end. Three No. 14 holes are drilled at $\frac{7}{8}$ in. centres, for the ends of the elements, and two with letter *C* (or $\frac{1}{4}$ in. if not available) at $\frac{1}{4}$ in. from each end, for the bends, which are made from $\frac{1}{4}$-in. tube as shown. The junction block is a piece of brass $\frac{7}{16}$ in. square, with a hole drilled through it, to take the outer ends of the bends, and a 19/64-in. hole drilled in the underside, into which is fitted the short $\frac{5}{16}$-in. pipe, with union nut and cone, for connecting to the vertical steam pipe attached to the cylinders. As inexperienced builders might find some little difficulty in silver-soldering the cone on the end of such a short pipe, and attaching same to the junction block, without messing up the nut as well, there is an alternative. Make the pipe and cone in one piece; chuck a piece of $\frac{7}{16}$-in. rod—copper for preference, but bronze or gunmetal would do—in three-jaw, face the end, and turn down $\frac{3}{4}$ in. length to a tight fit in the hole in the junction block. Part off at $\frac{3}{16}$ in. from the shoulder, reverse in chuck, centre and drill right through with 7/32-in. drill, turn the blob on the end to a sliding fit in the nut, and turn the edge to a cone, same as a union cone. Put on the nut, and squeeze the end of the pipe section into the junction block. If you push the nut right over the cone, and wind a few turns of asbestos string around the pipe, to prevent the nut from slipping while you silver-solder the joints on the junction block, everything in the garden will be lovely.

The illustrations show how the whole bag of tricks is assembled, so detailed description is needless; the whole of the joints can be silver-soldered at one heat. Pickle, wash, and clean up, and don't forget to let plenty of water run through, to shift any residue left from the silver-soldering. The elements are inserted in the flues, and the flange attached to the steam-pipe flange, with a gasket between, same as in the case of the $2\frac{1}{2}$-in. gauge engine. I have indicated the blower connection in the drawings, but this cannot be made until the boiler is erected.

Next Week . . .

"M.E." ALLCHIN TRACTION ENGINE

The construction of one of the trickiest parts, the cylinder unit is fully described.

ROTARY PUMPS AND MOTORS

The second article in this new series, dealing with the working principles of Centrifugal Pumps.

"NETTA"

It is now the turn of the 5-in. gauge engine to be equipped with regulator and superheater.

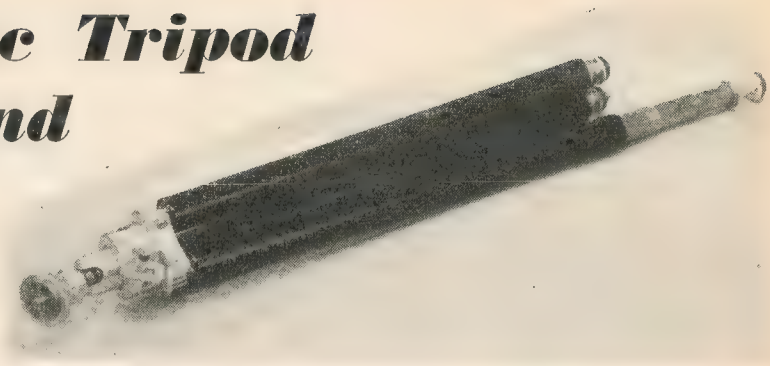
NOTABLE I.C. ENGINES

A description of the Taplin vertical twin compression-ignition engine.

AN 8 ft. MODEL CARGO LINER

The story of the building of this magnificent model is carried a step further. The builder's experiments and experiences will be found very helpful.

A Telescopic Tripod with Pan and Tilt Head



The complete telescopic tripod

By J. A. Murrell

As all photographers are aware, a tripod is an essential when photographing models and similar subjects. They are also aware of the price of a good quality tripod and a decent pan and tilt head. For the above reasons, it was decided that the tripod and head should be made in the workshop.

The tilt head is made mainly from aluminium and dural, all the pieces being odd ends of bar and plate scrap. The tripod itself is of telescopic brass tubing, this, of course, having to be purchased. The price is extremely high when buying small quantities, but nevertheless, the finished job is equal to a commercial article of at least five times its cost. If telescopic steel is used, the cost is about half, but there is always the fear of rust.

However, the designing and building of this job was most interesting, and if any amateur lathe owner wants some good turning practice, then a pan and tilt head are his answer.

The tripod and head shown in the photograph and drawings is in four sections, being about 4 ft. 6 in. extended, and 18 in. overall when closed, the finished article being very light and portable and most efficient in use.

Pan and Tilt Head

Item A. Base Block—This is turned from aluminium bar to $1\frac{1}{2}$ in. dia. The piece is next drilled through $\frac{3}{8}$ in. dia. and then counterbored 1 in. dia. × 3/32 in. deep. The block is now parted off $\frac{5}{8}$ in. thick. The diametrical holes are drilled later, on assembly.

Item B. Cover—The cover is of aluminium, turned to $1\frac{5}{8}$ in. o.d. It is then drilled and bored $1\frac{1}{16}$ in. dia. and then counterbored $1\frac{1}{2}$ in. dia. × $\frac{11}{16}$ in. deep. The end of the counterbore is cut to angle of 30 deg., as shown on the drawing. It can now be parted off, or reversed in the chuck, and faced off until the top is $\frac{1}{16}$ in. thick, as shown. The 2-B.A. clearance holes are drilled on assembly.

Item C. Socket—This is turned from aluminium bar to $1\frac{1}{2}$ in. o.d. or slightly under, to be a clearance fit in the cover. A $\frac{1}{2}$-in. dia. hole is next drilled right through, and this hole is then opened up to $\frac{5}{8}$ in. dia. The end of the bore is finished with a form tool ground to $\frac{5}{16}$-in. radius. The measurement from the face to the radiused end of the bore should be 1 3/32 in.

The 1-in. dia. spigot on the face can be turned next, 3/32 in. long. The rest of the turning can be done with a l.h. knife tool, a wide parting tool cut being taken in to give the tool a start, and the first diameter to be turned is 1 3/64 in., this being the size of the rear spigot. The tool should be withdrawn at an angle of 30 deg. to finish 3/64 in. from the face and the remaining portion is turned to 1 in. dia.

The job can now be parted off to an overall length of $1\frac{1}{8}$ in. During the process of parting-off, the radius can be partly formed. After parting off, the socket can be mounted on a $\frac{5}{8}$-in. dia. stub mandrel and the internal and external radii finished off. Next remove the job from the lathe, and drill a $\frac{3}{8}$-in. dia. hole through one side, at a centre distance of $\frac{3}{4}$ in. from the face. The end-piece can be sawn out, and the slot filed to size and shape.

Items D and E. Pressure Plug—The pressure plug is in two parts, *D* and *E*; portion *D* is turned to $\frac{5}{8}$ in. o.d. and the end is bored $\frac{3}{16}$ in. deep to suit a $\frac{5}{8}$-in. dia. ball. The piece is parted off $\frac{3}{8}$ in. long, reversed in the chuck and a $\frac{1}{8}$-in. hole drilled $\frac{1}{8}$ in. deep. Portion *E* is turned to $\frac{5}{8}$ in. dia., then for a length of $\frac{1}{2}$ in. is reduced to $\frac{3}{8}$ in. dia. It is then parted off $\frac{3}{4}$ in. overall length. A similar $\frac{1}{8}$-in. dia. hole is also drilled in this piece, as shown on the drawing.

Item F. Ball—This can be turned from brass to $\frac{5}{8}$ in. dia., or better still, a $\frac{5}{8}$-in. dia. ball-bearing can be softened. The ball can now be held in the lathe chuck, and drilled and tapped $\frac{1}{4}$ in. dia. B.S.W. Another hole at 90 deg. to the first is drilled and tapped 6 B.A. for a grub-screw. The slot for the pressure-screw or locking-bolt is left until later.

Item H. Bolt—This is turned from brass, the head being turned to $\frac{3}{8}$ in. dia. The bolt is screwed $\frac{1}{4}$ in. dia. B.S.W. for a length of 1 in., and then a shoulder $\frac{5}{16}$ in. dia. and $\frac{5}{16}$ in. long is turned on. The bolt is now parted off $1\frac{7}{16}$ in. overall to make the head $\frac{1}{8}$ in. thick. A slot is cut in the head with a hacksaw.

Item J. Lock-Nut—This is turned from a short length of aluminium $\frac{7}{8}$ in. dia. A hole is drilled and tapped $\frac{1}{4}$ in. dia. B.S.W. right through. The front portion is turned to $\frac{3}{8}$ in. dia. and then tapered to $\frac{5}{16}$ in. dia., as shown, after which the head is knurled and the 9/16-in. dia. portion is formed during the parting-off process ; the nut is then parted off $\frac{9}{16}$ in. overall length.

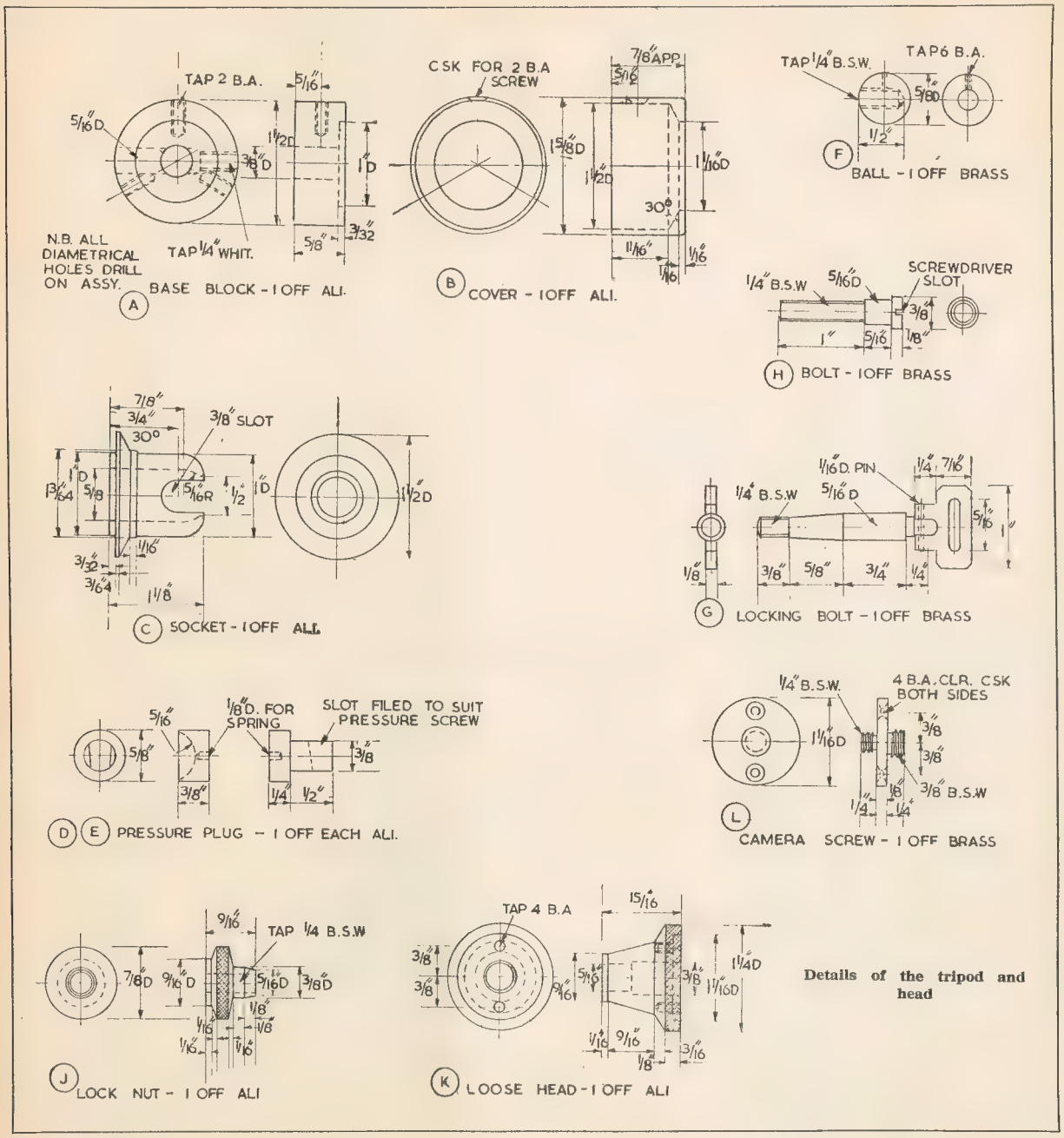
Item K. Loose Head—This is turned from aluminium bar to finish to $1\frac{1}{4}$ in. o.d. A $\frac{5}{16}$-in. dia. hole is drilled to pass right through. This is then opened up to $\frac{3}{8}$ in. dia., 41/64 in. deep, and the head is then conterbored $1\frac{1}{16}$ in. dia. × $\frac{1}{8}$ in. deep. The top can be knurled, and then the back portion reduced to $\frac{9}{16}$ in. dia. in two tapered steps, as shown on the drawing. The overall length is $\frac{15}{16}$ in.

Item L. Camera Screw—The camera screw is reversible, one side to suit British cameras, the other to suit Continental types. The outside diameter is turned to $1\frac{1}{16}$ in. to suit the counterbore of the loose head. One side is reduced to $\frac{3}{8}$ in. dia. and screwed $\frac{3}{8}$ in. dia. B.S.W. for a $\frac{1}{4}$ in. in length. This can be reversed in the chuck, and held by a $\frac{3}{8}$-in. dia. B.S.W. nut, and the other side now reduced to $\frac{1}{4}$ in. dia. B.S.W.

The job is now removed from the lathe and two 4-B.A. clearance holes drilled, as shown. These holes should be countersunk on both sides to suit countersunk screws. The screw can be fitted into the head and the 4-B.A. holes drilled and tapped in the head, to suit.

Item G. Locking Bolt—This is the last piece of the pan head, and is turned from brass. The end is screwed $\frac{1}{4}$ in. dia. B.S.W. The diameter then increases to $\frac{5}{16}$ in. through a length of $\frac{5}{8}$ in. Then a parallel length, at $\frac{5}{16}$ in. dia., of $\frac{3}{4}$ in., being finally reduced to $\frac{1}{4}$ in. dia. The bolt is parted off to an overall length of 2 in. A handle is filed to shape from $\frac{1}{8}$-in. plate as shown, and is fitted to the bolt with a $\frac{1}{16}$-in. dia. pin. The handle folds flat when not in use.

Assembly of Pan Head—The first part of this job is to fit the cover *B* over the socket *C*, and then over the base block *A*. When the end of the cover



Details of the tripod and head

and the bottom of the base block are level, there should be sufficient clearance for the socket to turn freely. The drawing gives 1/64 in., though this is the maximum; a few thousandths is all that is needed. If this is correct, then the 2-B.A. holes can be drilled and tapped, as shown on the drawings. At the same time, drill the hole for the locking bolt *G*. One side of the base block is tapped $\frac{1}{4}$ in. dia. B.S.W. the other side being opened up to $\frac{5}{16}$ in. dia.

The next step is to fit the pressure plug. First drop the ball into the socket, then the two pieces of pressure plug. Replace the cover and base block and tighten the three 2-B.A. screws. Place the assembly in a machine vice, and using packing strips against the top face of the cover, and a $\frac{3}{8}$-in. dia. plug against the end of the pressure plug, tighten the vice. This will force the ball into the socket and the socket against the cover, thus locking the assembly. Now spot through the $\frac{5}{16}$-in. dia. locking bolt hole with a drill, and then drill a $\frac{1}{4}$-in. dia. hole through the pressure plug. Dissemble, and using the top edge of the $\frac{1}{4}$-in. dia. hole as a guide, file the tapered slot in the pressure plug.

It may be necessary to assemble two or three times before the locking-bolt functions correctly. On the final assembly, fit the spring between the pressure plugs. This spring prevents the head falling when the locking-bolt is slackened off.

Next fit the loose head and lock-nut. The bolt *H* passes through the loose head *K*, through the lock-nut *J* and into the ball. Adjust the bolt until there is about quarter of a turn on the lock-nut

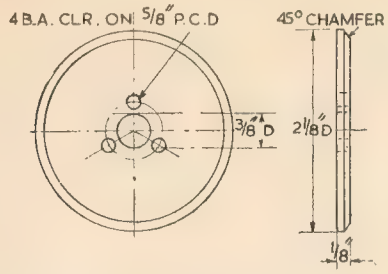
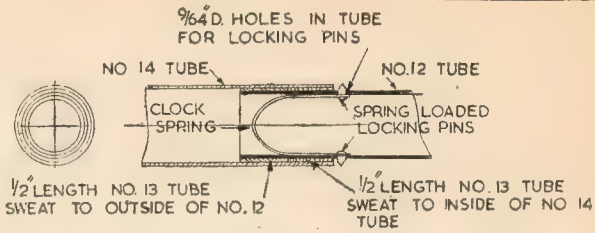
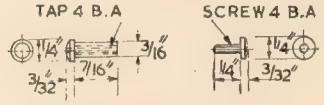


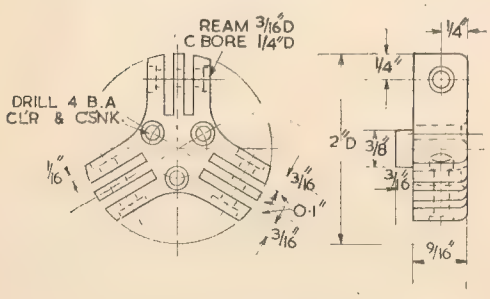
Plate M (1 off All.)



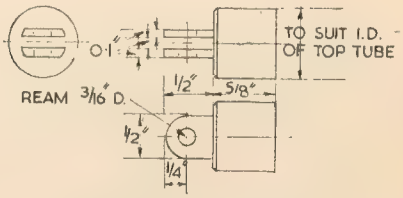
Details of telescopic system and locking pins



Hinge bolts P (3 off each)



Platform block N (1 off All.)



Hinge plug Q (3 off brass)

and then tighten the grub-screw in the ball. Finally fit the camera screw *L* to the loose head, and that part of the job is complete.

Tripod Platform

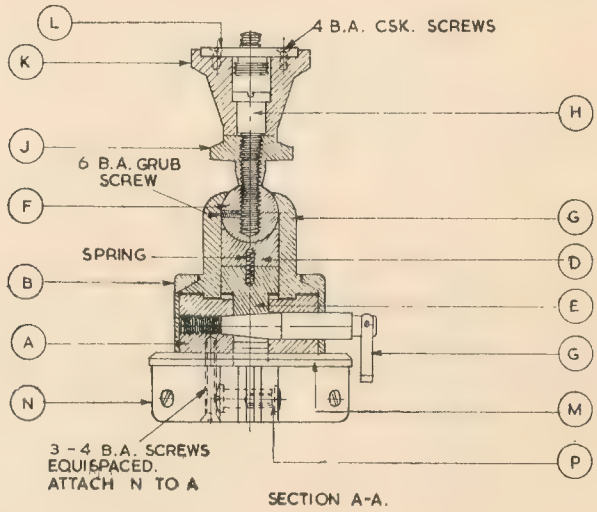
Item M. Plate—This can be cut from a piece of ⅛-in. aluminium plate. A rough circular piece can be sawn out, then drill a ⅜-in. dia. hole in the centre. Now mount this on a mandrel in the lathe and turn to 2⅛ in. dia. Chamfer the edge, as shown. The 4-B.A. clearance holes are drilled later.

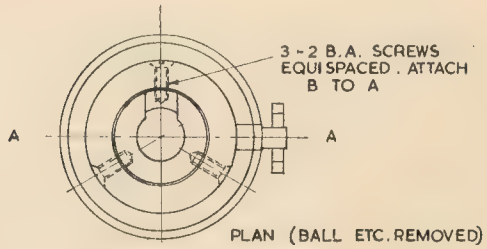
Item N. Platform Block—This can be cut from a thick plate of aluminium, or can be cast roughly to shape in a tin lid, as the original was. After filing to shape, the block can be held in the 3-jaw chuck and faced off. Reverse and turn the ⅜-in. dia. spigot.

The slots should be carefully marked out, as shown. If you have access to a milling machine, cutting the slots is easy. If not, then, as the original was made, the block can be bolted to the cross-slide and the slots cut with a fly-cutter mounted in the chuck. To facilitate clamping, a ¼-in. dia. hole could be drilled through the centre of the platform block.

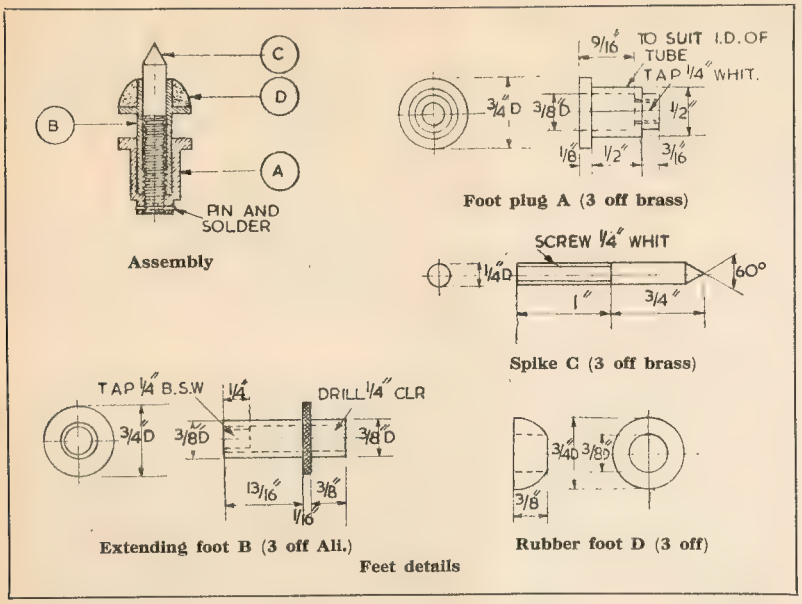
The 4-B.A. clearance holes can be drilled and countersunk, but the holes for the hinge bolts should be left until later.

Items P. Hinge Bolts—Each bolt consists of two parts, as can be seen on the drawing, the idea being that the bolt, as well as acting as a hinge pin, is also a means of tightening the arms of the platform block against the hinge plugs, the legs of the tripod staying in





The tripod head assembly



position by friction at this joint. The making of the bolts is straightforward turning, etc., the measurements being clearly shown on the drawing.

Item Q. Hinge Plug—These are made from brass. The main portion is turned to fit the inside dia. of the top section of each leg, and the front portion is reduced to ½ in. dia., ½ in. long, the end being radiused as shown. The slots are cut in a similar manner to those of the platform block.

The plugs can be fitted to the platform block, and, if necessary, the slots can be eased out with a file. Remember, though, that the leg itself acts as a lever, some 4 ft. long, so make the plugs a very tight fit.

The hinge bolt holes can now be drilled in the platform block and the hinge plugs. They should be reamed to size, as again the fit of the bolts needs to be tight.

Assembly—The platform block can now be attached to the pan and tilt head. First drill the holes in plate *M* to correspond to the 4-B.A. holes in the block. Now fit the platform to the base block *A*, with the plate *M* in between; the ⅜-in. dia. spigot will act as a register, just entering the block *A*.

The 4-B.A. holes can be spotted through on to the base block and then drilled and tapped. Make sure that these holes will clear the three 2-B.A. screws and the locking-bolt. Fit the three 4-B.A. screws and tighten hard home. The complete tripod head assembly is now finished.

Tripod Feet

To keep the lathework together, the opposite end, that is the feet, can be tackled next. It can be seen from the drawings and photograph that the fixed foot is a spike, but that a rubber foot can be unscrewed to lock beyond the spike. This is an essential when using the tripod on the best carpet! Each foot consists of four pieces, which should be quite clear from the drawing.

Item A. Foot Plug—The plug is turned from brass, the diameter being determined by the internal diameter of the lower section of the leg. This diameter is turned for $\frac{11}{16}$ in. and then the end $\frac{3}{16}$ in. is reduced to ⅜ in. The top diameter is ¾ in. and the job is parted off $\frac{13}{16}$ in. long. It is now reversed in the chuck and drilled through 13/64 in. dia., then being opened up to ⅜ in. dia. by $\frac{9}{16}$ in. deep. The remainder of the hole is tapped ¼ in. dia. B.S.W.

Item B. Extending Foot—The extending-piece is turned from aluminium to finish to ¾ in. dia. It is turned to ⅜ in. dia. for $\frac{13}{16}$ in., the ¾-in. dia. portion is then knurled. A tapping hole is drilled right through, the job then being parted off 1¼ in. long and reversed in the chuck. The end is reduced to ⅜ in. dia., ⅜ in. long and the hole is opened up to ¼ in. dia. clearance 1 in. deep, the remainder being tapped ¼ in. dia. B.S.W.

Item C. Spike—This made from ¼-in. dia. brass rod, 1¾ in. long. One end is tapered, as shown, to a point, and the other end screwed ¼ in. dia. B.S.W. for 1 in. of its length.

Item D. Rubber Foot—This is made from a tap washer. First a ⅜-in. dia. hole is made through it with a cork boring tool. It is then pushed on to the extending foot *B* and glued in position with Durofix. When the glue has set, the extending foot is held in the lathe chuck and at top speed the rubber can be smoothed off to final shape with emery cloth.

Assembly

The spike is screwed into the extending foot *B* until it stops. Then it is screwed into the plug A where it is pinned and soldered in position, as shown on the assembly drawing. Check that the extending foot moves freely; if so, the whole foot is finished.

Now for the legs themselves. The system employed should be clear from the drawing. If telescopic brass tubing is used, this can be ordered by numbers from the suppliers' list. If in steel, then fractional sizes are used. As the original is in brass, the numbered sizes are used. That is, the top section is a length of No. 14. Into one end is sweated a ½ in. length of No. 13. A similar length of No. 13 is sweated to the outside of No. 12, while at the other end a ½ in. length of No. 11 is sweated inside No.12 and so on.

The second section will be ⅝ in. shorter than the first, and from then on, each successive piece will be 1¼ in. shorter than the one above. This point should be clear, as the legs can only telescope as far as the locking-pins in the previous section. No lengths are given, as this depends on two factors: (1) the desired length when closed, and (2) the number of sections used.

The method of locking the legs should be clear from the drawing. The locking-pins are turned from brass; if four sections are used, then 18 pins are required. The springs are made from the remains of an extending rule, or old clock springs can be used. They should be riveted to the spring, as soldering will, of course, reduce the temper of the spring. When each leg is fitted with springs and pins, the hinge plug *Q* can be sweated into the top end, and the foot plug into the other end.

Much thought and enquiry went into the problem of covering the top section, when in one of our advertisers' lists there appeared the answer: "Black Plastic Insulating Tubing, 1 mm. wall thickness." An outlay of tenpence was all that was required and, as can be seen by the photograph, the job has quite a professional finish.

The photograph at the heading of this article was taken by Mr. A. Nutt.

NEW USES FOR CHAINS

In an interesting new booklet issued by Renold Chains Ltd., Renold House, Wythenshawe, Manchester, no less than 20 unusual and ingenious applications of roller chains, apart from the orthodox transmission of rotary motion between toothed sprockets, are illustrated. These include roller bearings for shafts or sliding conveyors, levers, cams, rack gearing, reciprocating and oscillating motion, and trip gear. In all cases the use of chains in these capacities may be exploited to reduce friction and destructive wear, or to save expense in construction or fitting. Each application is described and depicted in detail. Copies of the booklet are available on application to the above address.

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Properties of Metals

Can you please answer the following questions with regard to the properties of metals:

(1) *Does ordinary sheet copper lose any of its qualities by being repeatedly annealed?*

(2) *What is the equivalent thickness in inches of* 16, 18 *and* 20 *gauge copper sheet?*

(3) *What is the approximate melting temperature of brass?*

J.S. (Liverpool).

(1) The properties of copper are not, so far as we can ascertain, affected by frequent annealing, so long as the temperature is not raised beyond a dull red heat. If, however, such a temperature is maintained for prolonged lengths of time, the copper does deteriorate and tend to become extremely brittle.

(2) The equivalent thickness in inches of the gauges referred to are:

16 s.w.g.—0.064 in.
18 s.w.g.—0.048 in.
20 s.w.g.—0.036 in.

(3) With reference to the melting point of brass, there are several types of brass varying widely in physical properties and also melting points. The latter, therefore, may vary between:

855 deg. C.—1,570 deg. F.
995 deg. C.—1,825 deg. F.

Hornet Engine

With reference to the recent article on the 10 *c.c.* "*Hornet*" *engine, I have one of these engines installed in a race-car which has achieved quite satisfactory results. I should, however, like to improve upon its performance, and shall be obliged if you will give me further information on the conversion kit referred to. As it is probable that these kits would be unprocurable in this country, can you give me the size of the enlarged transfer ports, the carburettor venturi, alterations to the piston, etc.*

D.A.H. (Queensland, Australia).

As mentioned in the article referred to, complete conversion called for a new cylinder barrel. The liner was removed from the casting (by warming the latter) and, to the existing three transfer ports, two more were added, one each side, and the depth of all five increased to $\frac{3}{16}$ in. by filing the top edges. Without the widened transfer passage of the new casting, it would not be possible to take full advantage of the increased area. The engine also employed a new backplate with new carburettor venturi, but it is suggested that some improvement may be obtained by modifying components of the existing assembly, namely, by installing a larger bore carburettor (i.e. approx. 0.350-in. choke) and, on the rotor disc, filing away the bridge over the port. The design of the replacement piston did not appreciably differ from the original, but was a little lighter. It is not considered that this component would materially affect performance, as the original is a sound and well chosen design.

The main power increase obtained with the conversion kit undoubtedly came with the improved "breathing." Therefore it is suggested that your efforts be directed towards this end, with attention to such items as the alignment of the transfer passage joint between cylinder and crankcase. You may also find it worth while to experiment with different gasket thicknesses under the base flange, and, of course, with different fuel mixtures.

Treadle-driven Grindstone

I am constructing a treadle-powered grindstone having a grinding stone shaft $\frac{3}{8}$ *in. in dia., running on ball-races, with a vee pulley* $1\frac{3}{4}$ *in. dia. This is driven by means of a belt from a* 26-*in. dia. cycle wheel, with the usual crank. The arrangement is satisfactory, except that I would like to add a flywheel to the driving shaft and I thought of making one from sheet mild-steel. Can you suggest a suitable weight of flywheel?*

H.L.H. (Grays).

It is certainly an advantage to have a heavy flywheel on the treadle shaft, and within reason the heavier the better, so long as the bearings of the shaft are not overloaded.

It would be practicable to use a flywheel made from a disc of thick mild-steel plate as you suggest, but we cannot advise you where to obtain a suitable disc, and it would be quite a big undertaking to cut it out and machine it from sheet material. As an alternative, a much cheaper method of obtaining the necessary flywheel weight would be to use a concrete flywheel, which could be built on the basis of the existing cycle wheel by using wooden discs to serve as moulds, and pouring the concrete into the space so as to interlock with the spokes of the wheel. Some care would be necessary to get an accurate shape and proper balance, though the latter can be corrected if necessary by suitable weights attached to the wheel afterwards.

Trembler Coils

Can you give me the address of any firms who can supply small trembler coils to work off a flash lamp battery? I understand this type of coil was manufactured by M.I. Ignition & Accessories of Ewell, Surrey.

C.W. (Wath-on-Dearne).

We do not know of any firms who can supply small trembler coils at the present time. The M.I. Ignition & Accessories Co. do not, so far as we are aware, manufacture trembler coils, but only miniature non-trembler type coils, and these are still available from Messrs. Electronic Developments Ltd., Villiers Street, Kingston-on-Thames. It would be possible to convert a coil of this type to act continuously as a trembler by using a buzzer with a suitable condenser connected across the points to interrupt the primary circuit. Incidentally, none of these coils will work really efficiently on the current supplied by a flash lamp battery.

Vapourising Spirit Lamp

Can you give me some further information on the vapourising spirit lamp illustrated on page 43 *of* THE MODEL ENGINEER *dated July* 8*th*, 1954? *I should like to have the dimensions of the jet and burner tube in order to save experimenting. Possibly these dimensions would vary according to the size of lamp one wishes to construct.*

L.G.D. (Bexhill).

We have no exact particulars of the dimensions of the jet and burner tube, and in practice, it is almost invariably necessary to carry out some experimental work to get the best results with lamps of this type.

We suggest that the burner tube could, with advantage, be lengthened if the furnace space in the boiler permits, and that some restriction between the air inlet to the burner tube and the first slot, such as a small choke tube, would assist combustion. As a basis for experiment, we suggest that a jet of 0.015 in. dia. should be tried, and the rest of the appliance may be made about twice the full size of the drawing. As you will see, the burner could then be arranged to go quite easily within the limits of height you specify, and within reason the vapour pipe could be extended to much greater length.

The proportions of the burner tube, together with the choke or venturi tube, as shown on page 106 of the July 22nd, 1954 issue would, in our opinion, be adaptable to this spirit vapouriser.

The S.S. "Robert Allen"

THE STORY OF AN 8-ft. RADIO-CONTROLLED CARGO LINER

By Ivan P. Miller

The model S.S. "Robert Allen" tied-up

THE rails were soldered on and given a filling of solder on the upper side, diagonal stays being provided at intervals. Thin piano wire was then stretched around the stanchions in the slots and soldered in place, the solder filling the saw-cuts and providing a "blob" on the stanchions simulating the sockets on the prototypes. Although these railings can never be very strong, it is surprising how well they stand up in use.

Rings made from $\frac{3}{8}$-in. light brass tube are inserted in all post holes and are glazed with discs punched from celluloid secured by thinned Durofix applied with a small brush inside and out.

The outer casing of the funnel was made in very thin hard sheet brass, rolled to egg section and given a soldered lap-joint, whilst on thick wooden formers. Hard brass oval stiffening rings were then sweated in internally, and a conical copper rim was sweated in the top to steady the inner casing or uptake. The outer casing was set $\frac{1}{8}$ in. into the boiler casing, sweated in by gas blowpipe, flanged over and again sweated.

The boiler casing is of 18-S.W.G. brass riveted and sweated together with $\frac{1}{4}$-in. brass angles and is provided with access covers to the two down draught burners and the hand boiler-feed pump, and is pierced for the safety-valve easing levers and the boiler pressure gauge face.

Winches

Some fourteen winches were required, and, not fancying the large amount of repetition work involved, it was decided to die-cast them in type metal, although such work had never before been attempted. The job could, it was thought, be simplified by casting in one piece the frames and motors, and fitting, afterwards, a turned piece to form the drums or sheaves. A typical drawing of a winch was, therefore, dug out, reduced to scale, and the dimensions slightly altered as to width so that the mould could be built up from plates, either $\frac{1}{8}$ in. or $\frac{1}{16}$ in. thick as aluminium of these sizes was at hand, and be fitted with tubular or rod cores. A start was made by cutting out all the rectangular plates, bolting them together in a marked sequence and running over the pack in the hand shaper and drilling for the cores. On breaking down the embryo mould, each piece was carefully marked out with various details and then clapped against stops on to the faceplate of a small lathe and bored or drilled as needed; finishing off was done by abrafile and scraper. Care was taken to ensure that sufficient taper or draught was given to the parts so that the mould would separate easily from the casting when cold.

All that remained to be done then to start casting, was thoroughly to clean each piece of the mould, assemble complete with cores, clip on a cover-plate with an 8-in. header pipe, heat up the whole thing pretty hot and pour in the molten typemetal. To get good sharp castings, it was found necessary to "smoke" the surfaces of the mould by holding them over a wax candle, thus giving them a carbon surface which would apparently pick up any vaporised oil or grease that might still linger on the metal, and to have the typemetal hot enough to char paper when pushed into the top surface. As soon as the metal began to crystallise, the header tube was pulled away and the cores withdrawn; the time saved by adopting this method was considerable whilst there was the additional advantage that each was identical with the next.

The winches were then fitted with turned hardwood drums and painted in grey and black, and believe it or not, stuck with Bostik on to the decks, where they have remained in all weathers for some years.

Ventilators

Making the ventilators was evaded for a long while, there being so much else to do, i.e., until a simple method of producing realistic cowls could be found. Enquiries at the "M.E." Exhibition and elsewhere produced a variety of answers, amongst them "electroplating." This appealed strongly, but no details of currents or times were immediately available as to how to copper-plate lumps of lead. Nevertheless, an effort was made by preparing the necessary patterns in boxwood as being a nice substance to work, which would take a good finish by itself. Simple two-part moulds were made in dental plaster of paris in the usual way, and lots of solid lead ventilator cowls resulted. These were given a good surface and provided with tails by soldering 6 in. lengths of copper wire to the ends for suspension in the electrolyte; this, of course, was a saturated solution of copper sulphate got from the local chemist and rendered slightly acid by a drop of sulphuric. The solution so prepared was put in a glass jug of about 1-qt. capacity and 5 in. diameter, and a sheet of old copper found to line the jug and couple to the + terminal of a 12 volt lamp half-wave trickle-charger. As a start, two of the lead castings, coated with cellulose paint where no deposit was needed, were connected to the — lead of the charger, immersed in the middle of the jug, and the juice switched on. After perhaps half an hour a dark reddish brown mud had collected on the castings, which could be easily wiped off! So with little hope for any greater success, six were put in instead of two and set so that they were uniformly spaced and

Continued from page 594, *May* 26, 1955.

presented the bulk of their surfaces to the sheet of copper. After an hour, the deposit appeared bright salmon-pink and quite smooth and hard. With this heartening evidence, they were left for about four hours more and checked again, this time with a file, and were found to have real metallic copper coats perhaps 1/100 in. thick. They were, therefore, left for another three hours, or a total of eight hours, before switching off. It sufficed then to give them a rub over and trim the ends and bases with a smooth file before dropping them into molten lead to remove the interiors. It was quite a joy to pick out the cowls, which had floated to the surface of the molten lead, all ready to have stiffening wires soldered on their mouths and be sweated into tubular supports.

How far the technique departed from good practice, what the current density on the plated surfaces was, etc., are still unknown, but the idea worked fine. Before next time, however, a text book on the subject will be obtained. [*Percival Marshall already publishes one*—ED. "M.E."]

The anchor windlass on the forecastle was originally intended to be steam driven, as the idea of a fancy job exhausting in a realistic fashion over the side of the ship had a strong appeal. In fact, a pre-war Stuart Turner 2-cyl. ½ in. × ½ in. oscillating marine engine had been set aside for this purpose, the idea being to hide it below the deck and drive vertically into the windlass gearing. But the complications which would follow radio control for stopping, starting and reversing, together with the difficulty of keeping the forepart of the ship free from stray oil and water, decided otherwise, and the windlass was electrified instead, being worm-driven by a 12-volt No. 212 Graham Farish "OO"-gauge locomotive motor running on only 6 volts.

The frame is built from $\frac{1}{16}$-in. plate and $\frac{3}{16}$-in. angle brass riveted and sweated together to a design typical of a Clarke Chapman machine. The gear wheels and pinions were selected to be as lifelike as possible whilst the sheaves for the anchor chain or cable (10 links per inch) were built up by sweating flanged cheeks to steel sprockets, the teeth of which were formed with a rat-tailed file. The main and secondary shafts are of ⅛-in. and 3/32-in. silver-steel respectively, the former carrying the large gear wheels, brake drums, chain sprockets and drums sweated thereon. The secondary shaft carries a 40/1 ratio worm wheel and a pair of winding drums also. The motor is bolted to the underside of the baseplate and drives upwards.

The windlass is bolted to the deck, and is easily removed for servicing and for access to the twin chain lockers below. The overall gear ratio is 320/1 and sufficient pull is given so as to nearly sink the ship by the head if the anchor should get fouled on the sea bottom. The anchors, although quite small and light, will hold the ship in a fair breeze if the sea bottom is of hard sand or peaty in nature.

Painting

After three coats of grey paint were applied internally, the external red lead and goldsize coats previously mentioned were followed by more than a dozen undercoats, each rubbed down in turn, which varied slightly in grey colour, so that each would act as an indicator to the next. The later coats were rather richer in oil than the earlier, and were finished off with two coats to the appropriate colours of hard gloss paint and one of copal varnish, all, of course, rubbed down, including the varnish, which was given a matt surface with "Vim" as an abrasive. The rubbing down was greatly eased by the use of the finest grade of "wet and dry" carborundum paper on a ¼-in. felt-covered rubbing block about 2½ in. × 4 in. × 1 in. with plenty of water. The hull colours are venetian red below water line, black thence to well deck level and white upwards, whilst the superstructure is also in matt white; the decks nearly black except the boat deck, which is painted to the colour of beechwood. Masts and booms are coloured yellowish venetian red, and the funnel casing is stone colour with a blue band. The ventilators, deck houses, etc., are also in matt white, whilst details such as fairleads, bollards, etc. are grey.

The Ship's Machinery

Before dealing with this part of the work, it might be of interest to recall the considerations which were thought to have a bearing on their design. Having absolutely no data to work upon, a hesitant approach was made in terms of schoolboy arithmetic thus:—

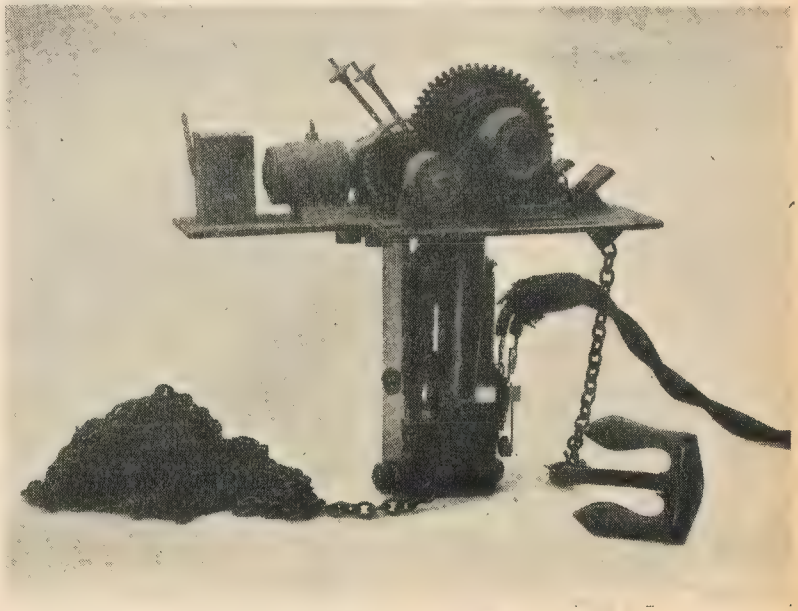
The prototype has a speed of 13½ knots, or just over 82,000 ft. per hour, and being 470 ft. long, she would travel about 1,750 lengths per hour. *Robert Allen*, being 8 ft. long, would have to do the same number of lengths per hour past some distant fixed object to look right; i.e., do 2 2/3 miles per hour, or something over 2 knots.

The proportions of the ship seem to call for a propeller 4 in. diameter and 4½ in. pitch, which would require a speed of about 620 r.p.m. at 100 per cent. efficiency, which, of course, is ridiculous, or up to 1,000 r.p.m. at approx. 60 per cent. efficiency, which incidentally might be difficult to achieve.

As to the power required to develop a thrust sufficient to give the ship a speed of 2 knots or so—we had not a clue except that when the laden hull was in the test tank one of us was able to tow her at about the right speed without much difficulty, and that a man could give out about ⅛ h.p.

The question was, then, could the engine in mind develop this? So, on the assumption that the steam pressure in the valve-chests could be kept at about 100 lb per sq. in., it would, perhaps, be fair to expect a mean effective pressure of say 40 lb. per sq. in., allowing for "wire-drawing" in port ways, or cut-off of 65 per cent., and a small back pressure due to throttling of the exhaust. And using this figure in the old formula for indicated horse power, it worked out at between ⅛ and 1/6. Friction in the engine and associated gear would, however, reduce this amount to say 1/10 h.p.

It looked, therefore, as if the engine was large enough, after all, and it was decided to use it with the comfortable



The windlass and anchor chain

feeling that we could, if need be, adopt a later cut-off or put up the working pressure or both.

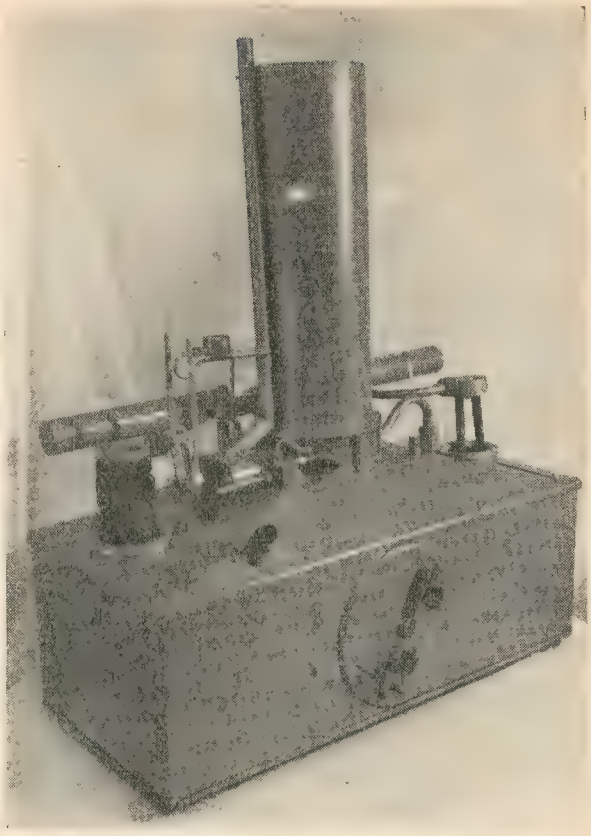
These small engines, we knew, were gluttons for steam, especially when the working pressure was low, superheat practically non-existent, and working with some back pressure on the exhaust. There would be the inevitable cylinder condensation, weeping at glands, and the demands made for power by a feed water pump and an air compressor. Furthermore, even if the boiler/burner efficiency were very good it would be unreasonable to expect an overall thermal efficiency of more than 3 per cent. at the most; in other words, the output from the boiler would have to be of the order of 33 times the engine's hoped-for 1/10 h.p., or, say, 3½ h.p., and on the basis of 1 h.p. per sq. ft. of heating surface some 3½ sq. ft. would be needed.

It was estimated, too, that at full output the boiler would have to put out about 9,000 to 10,000 B.Th.U. per hour (2,545 B.Th.U. per hour = 1 h.p.) and to do this we would have to burn paraffin at a rate of between 1¼ and 1½ lb. per hour at an efficiency of around 70 per cent., assuming paraffin to have a calorific value of 19,000 B.Th.U. per lb. Taking a gallon of paraffin as 8 lb. or 1 lb. per pint, this meant a fuel consumption of, say, up to 1½ pints per hour at full speed.

Despite the fact that all these figures might give a result wide of the mark, a variety of designs of boiler were examined and, knowing that the position regarding materials was much easier and that machining facilities were at hand, the job was tackled enthusiastically. A design which could carry a fair volume of water, be quick steaming and easy to make, and would enable the paraffin burners to be serviced in position was prepared, with a heating surface of 4,880 sq. in. (3.3 sq. ft.) mainly in water tubes arranged on each side of a big central drum. The design is in principle similar to the Blakeney boiler described some years ago in THE MODEL ENGINEER, but very different in the layout of the location of the drum and water-tubes, and also of the burners.

The circulation of the boiler water is very fast indeed, as the U tubes adopted take water from the lower part of the drum and discharge a mixture of steam and water into the steam space at the top of the drum. As fired, the tubes cannot easily overheat or the joints weaken whilst there is water in the drum. This rapid circulation has a very important part to play in securing high efficiency in a boiler, and could not be improved unless forced circulation be used.

The performance of the plant has, to our delight, of course, proved very satisfactory; but it showed on test that we had been rather pessimistic when assessing losses due to so many causes, it being sufficient here to say that with 60 lb. per sq. in. on the boiler, the ship exceeds 3 m.p.h., putting up a bow wave level with the well deck and a propeller wash like a detroyer "doing the knots." In practice, the boiler pressure is kept below 60 lb. per in. as this gives a realistic cruising speed, whilst 40 lb. per sq. in. is enough for manoeuvring under radio control in narrow waters. The fuel consumption is remarkably low in normal use, being of the order of 2/3 pint per hour, a figure which is confirmed by the fact that even when the burners are going full out, the hand can be held within ½ in. of the top of the funnel, whilst the original paint on the inner funnel remains intact. On test, the thermal efficiency exceeds 70 per cent. on full load.



A view of the boiler of the model S.S. "Robert Allen"

Success is perhaps to be attributed to the use of a boiler having plenty of heating surface and rapid circulation, and an engine not too big for its job, working with only 65 per cent. cut off. The engine, from rough calculations, is nevertheless the big offender so far as overall efficiency is concerned, as it consumes more than 150 lb. of steam per horsepower hour, or probably more than twice as much as it should. Small reciprocating engines working under similar conditions are always poor performers, but can be immensely improved by the use of superheated steam to cancel out the losses from condensation within the cylinders, and good valve gear. In the case of the *Robert Allen* the soft materials used in its construction prohibited little more than steam drying, but the whole plant behaves fairly well all the same.

The opinion has been formed that the adoption of a water-tube boiler of the type installed working at say 150 lb. per sq. in. and with 200 deg. F. superheat, driving a straight uncompounded reciprocating engine could give a very good performance indeed, whilst not being any more difficult to design and make than other types.

Schoolboy arithmetic was used again to determine the size of the feed pump, also, it being understood that the cut-off would be 65 per cent. and the r.p.m. 1,000; simple multiplication of area of cut-off and r.p.m., giving the volumes of steam required for the engine and the weight of water per min. from the pump.

Thus:—piston area 0.441 sq. in. × stroke 0.75 in. × No. of strokes 4 × cut-off 0.65 × r.p.m. 1,000 = 860 cu. in./min. steam.

This quantity would have to be doubled, at least, to allow for steam to fill port ways, condensation, etc., and was therefore increased to 1,712 cu. in. or say 1 cu. ft. per min., and, taking the admission pressure at no more than 60 lb. per sq. in., this amount would weigh 0.174 lb. as taken from steam tables. The pump however could "slip" and deliver perhaps only 80 per cent. of its swept volume, in which case the size of the pump should be based on 0.2 lb./min. or 1/5 lb./min.

But 1 lb. of water occupies a volume of approx. 27.7 cu. in., so the pump could be required to deliver 1/5 of this or say 5.5 cu. in./min. or 0.0055 cu. in. per stroke. A pump ram of 5/32 in. or an area of 0.0191 sq. in. would require a stroke of about 0.28 in. The feed pump actually made was 5/32 in. × ½ in. stroke and of a variable volume type. In normal use it operates at about 50 per cent. capacity, thus confirming the figures set out above.

(*To be continued*)

READERS' LETTERS

Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

EARTH WIRING

DEAR SIR,—I cannot agree with your correspondent's remark on earth-wiring, that "one does not use bell wire for this purpose." If "one" is an electrical contractor paid for doing a wiring job, he is bound by all sorts of grandmotherly "rules," possibly desirable in a factory or building in which the user is assumed to be fool. But one's own workshop is not a factory within the meaning of the act, and so "one" uses one's common sense; a commodity, I am sure, which "L.B.S.C." has never found "in short supply."

What is an earth wire for? It is intended that if defective wiring results in contact between bare metal, such as a lathe, and the live main, the fuse in the live main shall blow, and the bare metal cannot rise more than a volt or two above earth potential. So the size of the earth wire must be such that the fuse melts before the earth wire gets appreciably hot. In an average workshop, with 5 or 10 amp fuses in circuit, the fuse will blow on a short in 1/50 sec. or less—in this time a 22-S.W.G. bell wire will carry 20 amp for about 3 sec. before the covering begins to smoke!

"Earth-wiring" is a bit of a fetish, in many cases. I won't have an earth on my electric soldering iron or portable tool in the workshop; one may want to solder a join or drill a hole in a "live" instrument-case, and an "earthed" tool may do a lot of damage.

Much more dangerous than ineffective or deliberately removed earthing is the suicidal practice of using electric fires or portable irons, "infra-red" and "ultra-violet" devices, in a bath-room, where someone still wet from the bath may get a dangerous shock. If one is *dry*, it is almost impossible to get a *dangerous* shock from 230 volt mains: death has resulted from a 20 volt shock from a defective switch touched by an idiot sitting in a hot bath.

Yours faithfully,
Cambridge. C. R. COSENS.

DEAR SIR,—Having read with some interest Mr. J. W. Cooper's letter in a recent issue of THE MODEL ENGINEER, I was prompted to refer again to "L.B.S.C.'s" article in the issue of March 17th, and shuddered at the liberties our worthy friend was taking with Milly Amp.

I do not wish to be too critical of his efforts in the field of electrical contracting, but in the interest of the community may I be permitted to point out that:

(1) The size of the earth conductor is determined by the nominal cross-section of the conductor, except where the earth wire is contained in a flexible cord or cable.

(2) If you take liberties with Milly she will move quicker than you, and you may find yourself in the prone position on the workshop floor.

(3) The use of d.p. switchgear and fuses (except on d.c. circuits) is now not permitted.

(4) If you use lead-covered cable in your workshop, remember that it must be bonded and earthed.

(5) It is not sufficient to just use any old water pipe for the earth terminal; it must be a main water pipe and the resistance between the neutral conductor and the earth terminal must in the majority of cases not exceed the prescribed maximum of four-tenths of one ohm.

The above five items may tend to explain why "L.B.S.C." can do his job very much more cheaply than the qualified electrical contractor who has an obligation to the public and who is compelled by law to observe certain conditions.

May I, in closing, say, that if our worthy friend continues to save ha'-pennies in this way, he will soon be the richest model engineer in the grave yard.

Yours faithfully,
Taunton. R. E. HAWKES.

[*The two foregoing letters, it will be observed, express almost diametrically opposed views on the subject in question, and we would emphasise the fact that such letters represent personal opinions, and as such, are published without Editorial endorsement.*—ED., "M.E."]

COLLOIDAL GRAPHITE

DEAR SIR,—About 18 months ago, you very kindly put me in touch with Mr. Bennington Davies, on the subject of colloidal graphite.

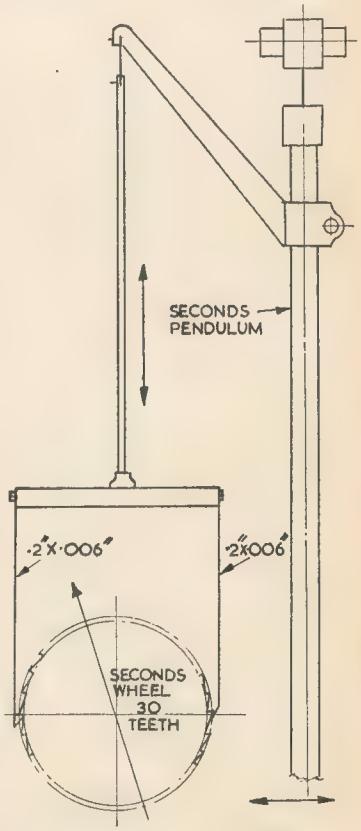
At that time I had been experimenting with a clock I had made. In it, the seconds hand is attached to an aluminium alloy wheel with 30 teeth. This wheel is driven by a push-pull arrangement attached to the top of the pendulum; (see sketch).

My trouble was that the friction varied between the push-pull fingers (steel) and the wheel. I found that if the wheel were dressed with pencil lead, the clock went beautifully for a few weeks and that then the arc became less and the rate deteriorated.

The article on colloidal graphite in THE MODEL ENGINEER suggested to me that graphite in this form might do the trick, but it also gave the impression that colloidal graphite could only be obtained in grease or oil which would, of course, be useless.

Through your kind assistance I got into touch with Mr. Bennington Davies and he, most generously, sent me some colloidal graphite in alcohol and suggested that I should dilute this with carbon tetrachloride and apply it to the surfaces of the wheel teeth with a paint brush.

I did as he advised and the result was entirely successful. So far, after running



for about a year and a half, no apparent variation of arc seems to have been caused by variation of friction between the push-pull fingers and the wheel.

As a matter of interest I should record the fact that the colloidal graphite did not reduce the friction *quite* as much as the pencil lead, but the difference was negligible.

I am, indeed, most grateful to you, to Mr. Bennington Davies and to Messrs. Acheson Colloids Ltd.

Yours faithfully,
A. RICKARD TAYLOR, M.A.
Lymington.

MODEL TRACTION ENGINES WANTED

DEAR SIR,—I have been approached by the general manager of one of Smith's Potato Estates to see if I can help him to obtain the loan of *two* model traction engines (i.e., the types used for threshing with drum and elevator), and any model agricultural implements of any kind. They are intended for display on their stand at a large Fete in July, at Osterley.

If anyone is in a position to lend any such models, and would care to get in touch wih me as soon as possible, I can give them further details. Transport and insurance of the models can be arranged.

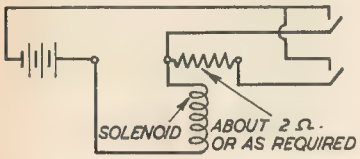
The matter is fairly urgent, and any help any of the model engineer readers of your publication can give, will be most appreciated. The models should not be more than 18-21 in. long, incidentally.

Yours faithfully,

Narrow Gauge Railway Society — E. G. COPE. Hon. Secretary.

DOOR CHIMES

DEAR SIR,—I read with interest the article and letter about a "ding dong" door bell and the indicator for use when the chimes ring from more than one position.



The indicator is completely unnecessary, and some types of commercial chimes are made to operate by sounding both gongs for one door and one only for the other door.

This is arranged by fitting a small resistance in the circuit, as shown in the diagram, the idea being to limit the current through the coil, so that the hammer does not travel so far, and hits the second gong on the return journey.

Trusting that this information puts some light on the matter and saves someone a little time and trouble.

Yours faithfully,

Aldeburgh. E. C. WRIGHT.

ALKALINE ACCUMULATORS

DEAR SIR,—With reference to your reply to F. G. G. (Belvedere), in the April 28th issue, there is a special low-resistance type of alkaline accumulator (NIFE) for use in cars. The ordinary type will not do for starting, although it will perform all the other functions, being practically indestructable if kept in use. If your correspondent's Nife 60 amp-hr. battery is of the high-resistance type, he will be inclined to blame the battery when it fails to perform a duty for which it is not designed or suitable.

Messrs. Nife Accumulators will give any queries the most courteous attention.

Yours faithfully,

Newport Pagnell. W. MACEY.

Radio-controlled Models in B.A.O.R.

By Capt. T. A. E. Pollock, R.Ir.Fus.

CAPTAIN N. A. F. Edwards, R.E., Garrison Engineer at Hannover, B.A.O.R., has a hobby which has brought him fame north and south of the equator. He makes radio-controlled gadgets which amaze his non-technical friends, and one of which created alarm, not to mention despondency, in the hearts of a few not-so-innocent fishermen in Hong Kong. But of that more later.

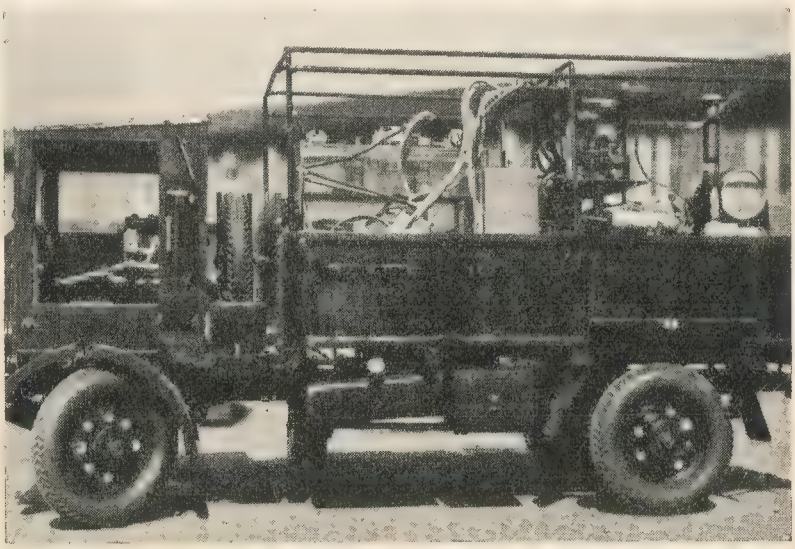
Captain Edwards is seen on the cover of this issue with his perfect 1/12 scale model of an Austin 3-ton truck (G.S.), with which he recently won first prizes at the Hannover Garrison and Hannover District Arts and Crafts Exhibitions. The truck, operating on 27 mc/s, is radio-controlled over a range of 500 yards, moves left or right, has three forward gears and a reverse, and hoots if anything gets in the way. Soon he will have the traffic indicators moving at a touch of the telephone dial which controls the truck's movement.

The steering is done by means of a small wheel at the transmitter, and the gear changing, horn and reverse are controlled on the telephone dial. Different combinations of numbers are used for the various movements required, and a selector mechanism on the truck does the rest. Incidentally, the canopy frame on the truck acts as antennae for the receiver. The truck has correct suspension and a correct differential gearbox.

Captain Edwards is at work now preparing plans for a landing craft to carry the truck across water. The L.C. will be controlled on a different frequency. As soon as it touches the shore of one of the local lakes or reservoirs, the ramps will come down, a quick change of frequency, and out will trundle one truck (G.S.).

Last Christmas, Chez Edwards guests were driven frantic trying to beat an electronic noughts-and-crosses machine which he produced for their diversion. Not one succeeded; but then, neither did the inventor himself. In both the Arts and Crafts Exhibitions in Hannover last year, Captain Edwards won firsts with another exhibit. This was a 1/120 radio-controlled scale model of H.M.S. *Kenya*. This twin-screw model operates over a range of three miles, moves to port or starboard, and has three speeds ahead and astern.

H.M.S. *Kenya* is the "alarm and despondency" model. When Captain Edwards was in Hong Kong in 1952 he took it down to the harbour one day, and sent it about its business. About 500 yd. from the shore he halted it for a moment, and it was then that he noticed the three Chinese fishermen. They saw the ship but didn't see him, and hastily dragging their lines in, these oriental followers of Walton rowed their junk over to this obvious bit of loot. Captain Edwards then made the ship circle the junk twice, and as he brought it gently away the Chinese had had enough. Uttering piercing screams they jumped overboard and struck out in the opposite direction to this mechanical "foreign devil." The local Chinese press had something to say about the incident.



The Austin 3-ton truck (G.S.) radio-controlled scale model

WITH THE CLUBS

The Wallasey M.P.B. & Y. Club

At a recent meeting of the above club, the hon. secretary Mr. R. L. L. Don, tendered his resignation; which was reluctantly accepted. The undersigned has now taken over the duties of hon. secretary, and all correspondence relating to club matters should be addressed to him in future.

The club's annual open regatta will be held at Central Park, Wallasey, on Sunday, July 10th, 1955, at 11.0 a.m. Events will include: Steering, Nomination and Hydroplane competitions. Visitors will be welcomed.

Hon. Secretary: H. V. YOUNG, 9, Eastcroft Road, Wallasey.

Tonbridge M.E.S.

Saturday, May 7th, 1955, was a very special day for the Tonbridge Model Engineering Society. We had Mr. J. N. Maskelyne as our visitor at a well attended track day. We also had a visit from the Orpington Society. Their members arrived in force and brought a number of fine locomotives with them.

We were favoured with excellent weather, and as our own members turned out in good numbers, with their locomotives, running went on for several hours. At times, traffic density became rather high with as many as five locomotives running at one time.

Tea was provided by members' wives and everyone seemed to enjoy the occasion thoroughly.

We would like neighbouring clubs and lone-hands to know that we will be very pleased to welcome them and their locomotives at our track on the Lower Castle Playing Fields. We can accommodate 3½ in. and 5-in. gauge locomotives; the track is continuous and 480 ft. round, and if visitors tire of running engines they can take a boat out on the River Medway or go for a swim in the Town Baths.

Hon. Secretary: R. H. PROCTOR, Roslyn, Coldharbour Lane, Hildenborough, Kent.

Rednal & District S.M.E.

The last week of April saw the first evening of the above society at their branch at Barnt Green. The meeting was well attended, work was resumed on the track; well, that is what was intended before Mr. Strickland arrived with his "Juliet." It was noticed that the frames on this locomotive had stretched out to 5-in. gauge. This must have been caused by awakening from its winter sleep! Also, on looking between the frames, one saw a large "U" type magnet around the water pump eccentric. Whether this was to get a short drive for the pump, or to attract the third rail, and thereby obtain extra adhesion, we must wait and see. About 9.30 p.m., as it was quite dark, the track was closed down and the members re-assembled at the chairman's home, where, thanks to his good lady, tea and cakes were consumed. The meeting broke up at 11.0 p.m., and it was apparent that a good evening had been enjoyed by all.

Should any person wish to try out his locomotive (3½-in. or 5-in. gauge) on the club's 180-ft. track, please write to the Secretary: J. TARRANT, 38, Middle Drive, Rednal, near Birmingham.

The Tyneside S.M.E.E.

Many members will recollect the entertaining talk given some years ago by Dr. G. W. Spark. Dr. Spark is going to give a similar talk on "The Human Machine" on Saturday, June 18th, at 2.45 p.m. in the rooms of the Newcastle Photographic Society, 6, Rutherford Street, Newcastle upon Tyne.

The portable track will be in operation on Saturday, June 11th, at the North Eastern Electricity Recreation Club's Recreation Ground, King's Road, Wallsend. Volunteers for erecting, driving and general labouring should get in touch with Mr. V. M. Lewitt or Mr. H. H. Watson.

Pending the appointment of a new secretary, all correspondence, other than financial, should be addressed to the chairman, Mr. F. L. Davies, 18, Belmont Avenue, Monkseaton, Northumberland.

Tees-side S.M.E.E.

The annual general meeting of the society was held in Middlesbrough on May 2nd, 1955, when the retiring officers were thanked for their services and those for the current year were duly elected. The exhibition manager was thanked for his work in organising the very successful exhibition, an effort worthy of much greater support. The associated small gauge railway and model car groups were also thanked for their part in the exhibition.

Hon. Secretary: J. W. CARTER, 28, East Avenue, Billingham, Co. Durham.

Stockport and District S.M.E.

The annual general meeting of the society was held on Friday, May 6th, when officers for the next twelve months were elected. A programme of talks, works visits, etc., is now being drawn up.

The society has a continuous multi-gauge track at Davenport, and a boat-testing tank is available at the same site. Meetings are held on the first and third Fridays of each month at The Forester's Hall, Churchgate, Stockport, at 7.30 p.m. Visitors are always welcome at any meeting.

Hon. Secretary: D. MAPP, 163, Mauldeth Road, Withington, Manchester, 20.

Norwich & District Society of Model Engineers

A meeting of the above society was held at the Assembly House, Theatre Street, Norwich, on May 11th, with Mr. P. Bailey in the chair.

Mr. A. A. Taylor, who has served the society as hon. secretary for many years, offered his resignation from this office, which, owing to pressure of private business of late, he has been unable to fulfil as he would have wished. Mr. P. Bailey proposed a vote of thanks to Mr. Taylor for all his work for the society, which was received with applause from all present.

Mr. A. W. E. Hoskins was elected to fill the vacancy of hon. secretary, and the business of the evening concluded with the arrangement of a provisional programme for the rest of the year.

There will be no meeting at the Assembly House in June; instead, on Wednesday, June 8th, at 7.0 p.m. a "Loco Meet" will be held in the grounds of St. Mary Magdalene Vicarage, Silver Road, Norwich, by kind permission of the Rev. R. Cooling, whose 3½-in. gauge track will be available to all.

Hon. Secretary: A. W. E. HOSKINS, 135, Newmarket Street, Norwich, Norfolk.

The Bristol Railway Circle

Members interested in any of the undermentioned proposed outings are asked to contact the secretary.

Lineside Watch at Yatton.

Circular trip, Bristol, Bath, Radstock, Pensford, Bristol. Visit to 10¼ in. gauge railway at The Royal Anchor Hotel, Liphook, Hants.

Hon. Secretary: J. F. BURRELL, 80, Longmead Avenue, Bristol 7.

Heywood Model & Aero Engineers' Society

We had a most successful meeting on May 6th, when Mr. W. J. Hughes gave his lecture, "A Century of British Steam Road Traction," before an invited audience of 42. Among those present were visitors from Ashton, Bury, Rochdale, Whitefield, Bolton, Eccles and Middleton. Mr. R. O. Harper, president of the N.A.M.E., very kindly provided and operated his projector. At the close of the most interesting lecture, a lively discussion took place; and then Mr. Hughes was invited to become an honorary life member of our society, and he gratefully accepted the invitation.

Hon. Secretary: R. WOODS, Lilstock, Hopwood, Heywood, Lancs.

Exmouth and District S.M.E.E.

The above society is holding an exhibition at the Y.M.C.A. Hall, Victoria Road, Exmouth from Wednesday, August 10th to Saturday, August 13th inclusive. It will be opened by the president H. Jarvis Graves on the 10th at 7.30 p.m. Remaining days open 10.0 a.m. to 9.0 p.m.

Hon. Secretary: R. D. N. SALISBURY, The Croft, Gussiford Lane, Exmouth.

THE MODEL ENGINEER DIARY

June 5th.—St. Albans and North London Societies.—Joint regatta at the lake, Verulamium, St. Albans. Starting at 2.30 p.m.

June 11th and 12th.—Birmingham Society of Model Engineers.—Annual National Rally of Steam Locomotives at the track at Campbell Green, 87, Horse Shoes Lane, Sheldon, Birmingham.

June 11th and 25th.—Bristol Society of Model and Experimental Engineers.—Public days at the track, Canford Park.

June 12th.—S. London Model Engineering Society.—Regatta at Brockwell Park, London, S.W. Starting at 11.0 a.m.

June 18th.—Ickenham & District Society of Model Engineers.—Official opening of new permanent headquarters and exhibition of models. Ground behind the "Coach & Horses," by Ickenham Pump, Middlesex.

June 19th.—Coventry Model Engineering Society.—Regatta at Nauls Mill Park, Coventry. Starting at 11.30 a.m.

June 25th and 26th.—The West Riding Small Locomotive Society.—Rally of Model Locomotives, Gauges 2½ in. to 7¼ in., at Blackgates House, Bradford House, Tingley, Wakefield. Open from 10 a.m. to 10 p.m. both days.

June 26th.—Victoria Model Steamboat Club.—Regatta at Victoria Park, Hackney, London, E.9. Starting at 11.0 a.m.

July 9th.—Vickers-Armstrongs Limited (Weybridge) Model Club. Annual exhibition, at Vickers-Armstrongs Limited, Sports Ground, Kings Head Lane, Byfleet, Surrey.

August 9th, 10th, 11th, 12th and 13th.—Weymouth & District M.E.S.—Exhibition of models, at the Melcombe Regis Boys School, Weymouth. Open from 11.0 a.m. to 9.0 p.m. daily.

August 17th, 18th, 19th, 20th, 22nd, 23rd, 24th, 25th, 26th and 27th.—The Model Engineer Exhibition, in the New Horticultural Hall, Greycoat Street, Westminster, S.W.1. Open from 11 a.m. to 9.0 p.m.

CONDITIONS OF SALE

This periodical is sold subject to the following conditions, namely, that it shall not, without the written permission of the publishers first given, be lent, resold, hired-out or otherwise disposed of by way of trade except at the full retail price of 9d., and that it shall not be lent, resold, hired-out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of trade; or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.

COPYRIGHT

All rights in this issue of THE MODEL ENGINEER are strictly reserved. No part of the contents may be reproduced in any form without the permission of the publishers.

CORRESPONDENCE

The Managing Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Correspondence and manuscripts should not be addressed to individuals, but to the Managing Editor, THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Private: 3d. per word. Trade: 6d. per word. Minimum 12 words. Use of box 1s. 0d. extra.

THE MODEL ENGINEER

Rates for displayed advertising in this section 35s. per single column inch 1⅞ inch wide.

CLASSIFIED ADVERTISEMENTS

The Advertisement Manager reserves the right to refuse or suspend advertisements without giving any reason. No definite date of insertion can be guaranteed. Every care is taken to avoid mistakes, but the publishers cannot be held liable in any way for printing errors or omissions. Receipt of "copy" for publication implies acceptance of these conditions by the advertiser. Whilst every care is taken to exclude advertisements from doubtful sources, no responsibility can be accepted by the publishers for the bona fides of advertisers.

WORKSHOP EQUIPMENT

Buck & Ryan for Lathes and Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661.

The Acorn Machine Tool Co. (1936) Ltd. are in a position to undertake the complete rebuilding of Atlas, Acorntools, Sphere and Halifax lathes, or if preferred, we can supply any spare parts that may be required for these machines. Full range of accessories and equipment for all these machines also available. Generous allowance given on old machines against the supply of new "Acorn" lathes. Second-hand machines of Atlas and Acorntools manufacture, rebuilt by us available from £75 each. Write to—610-614, Chiswick High Road, W.4. Tel.: Chiswick 3416-7-8-9.

High Speed Sensitive Power Bench Drilling Machine. Chuck capacity ⅜", £6 10s. or credit terms 2s. 6d. weekly. Send s.a.e. for descriptive pamphlet.—WANSTEAD SUPPLY CO., 48, High Street, London, E.11.

Wanted. Little John Lathe, second-hand but in good condition. Please give age and accessories.—Box No. 7665, MODEL ENGINEER Offices.

Rebuilt Lathes. The Acorn Machine Tool Co. (1936) Ltd. offer rebuild to limits "Acorntools" and "Atlas" 10" swing s.s. available. Write—610-614, Chiswick High Road, W.4. (Phone: CHI 3416.)

That New or Second-hand Lathe you require, get it from Corbett's (Lathes), Stanton Hill, Sutton-in-Ashfield. Low hire purchase terms, part exchanges, and value for money. Lists 1s. Amateur Lathe book 15s.

£50 M.L.7 as new, motorised, chucks, etc. "M.E." volumes, 101, 111, inclusive. "Tich" partly finished, "M.E." drill castings.—2, Isabella Road, Homerton, London, E.9.

Wanted. Model B2 Pittler lathe with accessories. Must be good tool. Coventry self-opening die head to screw to ⅜".—Box No. 7731, MODEL ENGINEER Offices.

Elementary Woodwork, by F. H. Harmsworth. This practical book of construction is the beginner's guide to woodworking *par excellence.* 5s. from your bookseller, or 5s. 6d. from—PERCIVAL MARSHALL & CO. LTD., 19-20, Noel Street, London, W.1.

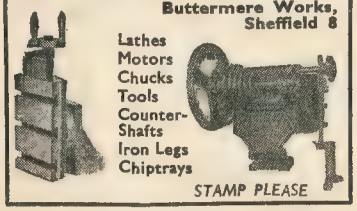
M.L.4 Motorised stand 3½" × 24", chucks, etc., £25. Starret set 224, 0"-4" mike, 2"-6" internal clock gauge, £10 10s. 0d. o.n.o. —CASSELDEN, 8, Laurel Road, Barnes, S.W.13.

Drummond 4" Lathe on iron stand, treadle, chucks, tools, drills, taps, dies, files, vice, bench. S.A.E. for list, £20 lot.—J. F. DEWSALL, 31, Ladysmith Road, Enfield.

Winfield 3½" Lathe, gap bed, two chucks, motor and all accessories. Best offer.—Box No. 7738, MODEL ENGINEER Offices.

Holtzapffel Ornamental Lathe, chucks, cutting frames, drill-spindles, compound slide-rest, spiral apparatus, mahogany cabinets. Stamp for list. Seen by appointment.—S. PYBUS, 31, College Road, Isleworth, Middx.

CHARLES PORTASS & SON
Buttermere Works, Sheffield 8



Lathes
Motors
Chucks
Tools
Counter-Shafts
Iron Legs
Chiptrays

STAMP PLEASE

Bearings and How to Fit Them, by Ian Bradley and Norman Hallows. Includes many examples of bearing design with simple diagrams. Plain bearings, ball bearings and roller bearings are described in detail, and advice given on the best materials and methods for making them. 3s. 6d. from your bookseller or 3s. 9d. post free from—PERCIVAL MARSHALL & CO. LTD., 19-20, Noel Street, London, W.1.

Workshop Comprising: Small Exe centre lathe, ¾" spindle cap., 16 speeds, many attachments, motorised c.i. cabinet stand; little lathe ⅝" spindle cap., chucks, etc.; 15' line shaft, bearings, pulleys, single phase repulsion motor; nibbler, 12" throat, 3/16" plate cap., 150 r.p.m.; Q. & S. No. 4 flypress, Besco 12" treadle guillotine, 6' steel bench, 6" hand shaper, swaging machine and bending rolls. £150 o.n.o.—RIEMSDIJK, 40, Bancroft Avenue, London, N.2.

Acorntools 7" Stroke precision high speed shaping machine on maker's cast-iron stand complete with swivel base, machine vice, rotary index table, index centres, motorised ⅛ h.p. single-phase, 230-250 volts, run few hours only, cost £145, perfect condition, £105.—ANDERSON, 17, Yateley Crescent, Great Barr, Birmingham.

Tyzack Lathe, 12" between centres, auto feed, 3" chuck, faceplate, gears, tools, etc., ¼ h.p. motor circular saw, grindstone attachments, good condition, £25.—42, Raleigh Road, Richmond, Surrey.

Foot Bellows and Gas Brazing blowpipe by William Allday & Co., in new condition, 50s.—R. NORTH, Rougham, Norfolk.

Portmac Type B vertical milling machine (list price £125), very little used and as new. Offers?—Box No. 7741, MODEL ENGINEER Offices.

Wanted. Internal and external grinding attachment to fit Drummond "M" type lathe, must be original Drummond make.—T. MALLABY & CO., 66, Meadow Lane, Leeds 11.

Ornamental Turning Lathe for sale. Extensive equipment. Fully motorised, ready for use. Immaculate condition. Details from—Box No. 7745, MODEL ENGINEER Offices.

MODELS AND FITTINGS

Stocks of Locomotives from 2½"-10¼" gauge.—MINIATURE TRANSPORTATION LTD., 2, The Arcade, Liverpool Street (Met.). Station, London, E.C.2.

Half-share in passenger-carrying miniature steam railway in South available to enthusiast. Lucrative, congenial occupation at popular seaside resort. Capital required nearest to £1,000—audited accounts—first deposit secures.—Box No. 7726, MODEL ENGINEER Offices.

Free Lance. 2½" gauge 4-6-0 locomotive, exceptional condition. Offers.—ARNOLD HARPER, 84, Crosby Road, Bolton, Lancs.

For Sale. "Princess Marina," £45 or exchange good example "Tich." Also motorised G.W. lathe.—CLARKSON, 2, Grove Road, Fareham, Hants.

Tug, Methy. Fired. Silver-soldered Smithes boiler, D.A. oscillating, wooden hull 26½" lined asbestos, superstructure aluminium, case and stand, £25.—Box No. 7729, MODEL ENGINEER Offices.

Traction Engine M.E. 1" scale superb finish complete with travelling case, £35. Dyak ½" scale good workmanship, £25.—EADY, Barklye Cottage, Broad Oak, Heathfield, Sussex.

Wanted 3½" Gauge "Maisie" in running order.—QUIGGIN, 6, Grantchester Road, Cambridge.

Complete Radio-control Outfit, as new. Including Mark I actuator 1061, hand transmitter 951A receiver 0.3 amp meter and all batteries. First reasonable offer secures.—SMITH, 8, Cemetery Avenue, Sheffield, 11.

Busy Bee Bantamag ball races, rings, etc., unused. Also part finished "Princess Marina" chassis. Sell or exchange for small tools. Wanted, motorised bench drill.—C. SORRELL, 3, Wychbold Crescent, Lea Hall, Birmingham, 33.

Locomotive 2½" Gauge Boiler. Smokebox, frames, cylinders finished. Tender-frames lot castings, wheels, etc., bargain, £3. About 300 "Model Engineers," £1. Buyer collects, or pay transport.—Box No. 7744, MODEL ENGINEER Offices.

MUSICAL MOVEMENTS !!!
For Cig. Boxes, etc., 16/6 each
Also Long Playing Tunes, 25/- each
S.A.E. for Tune List 2/3 *days delivery*
Repairs undertaken
M. MOSS
63, Fontwell Pk., Ashford, Middx

Sale. 7¼" Gauge 4-4-0 chassis, wheeled brakes, fitted spring buffers, screw couplings, £18. 7¼" gauge 4-wheeled truck, steel frames, brakes fitted, spring buffers, link couplings, £6. 7¼" gauge bogie truck as above, less brakes, £8. Full details on application, o.n.o. —Moss, 13, Schofield Street, Leigh, Lancashire.

3½" Hielan' Lassie. Good passenger hauler, much detailed, any trial, £120 o.n.o. Photographs.—BONNERT, 36, Royston Road, Bearsted, Nr. Maidstone.

Sale. Model Boilers in brass and copper, size 5" × 10" vertical, new and tested.—MATTHEWS, Wrawby, Brigg, Lincs.

Introducing Model Engineering, by H. R. Hadlow. "Introduction" is the keynote of this attractive volume in which the author brings to the novice the fascination and simplicity of model engineering in all its many branches—"live steam" and electric locomotives, petrol engines, ships, boats, aeroplanes. The book shows what the beginner can achieve with only the simplest of equipment. 3s. 6d. from your bookseller or model shop, or 3s. 9d. post free from—PERCIVAL MARSHALL & Co. LTD., 19-20, Noel Street, London, W.1.

6" Gauge Atlantic Locomotive and tender, passenger truck, rails, sleepers, buffer stops, signal, £175, or offers.—Below.

5" Gauge Fayette Locomotive chassis, Baker valve gear, cylinder castings, blueprints, £12 10s. 0d. or offers.—ROPER, 91, Westway, London, W.12.

ELECTRICAL

A.C. Motors Capacitor Start induction, 200/250 volts, 50 cycles, 1 phase, 1,425 r.p.m., ¼ h.p., £3 12s. 6d.; 1/3 h.p. £4 17s. 6d., ½ h.p., £6 10s. 0d. Perfect and guaranteed. Passenger carriage, 5s.—JOHNSON ENGINEERING COMPANY, 319, Kennington Road, S.E.11. Reliance 1412/3.

House Service Meters, 220/250 volts, (a.c. or d.c.). Credit or prepayment type.—UNIVERSAL ELECTRIC CO., 220, City Road, London, E.C.1.

Electric Motors, generators, starters, ⅛ to 40 h.p., a.c. or d.c., 100-350 volt, switches, cables, electric tools. Exchanges.—VERNON SMITH LTD., 354/366, King Street, London, W.6. RIV 3964.

New 100' Coils 1/22 P.V.C. wire, 1s. 8d. per coil, 9s. 6d. for six, ideal for bells, set wiring, indoor aerials, etc.—HOLDERNESS, Wantage, Berks.

Electric Motors, pulleys, etc. All types available from stock. S.A.E., stating requirements.—J. S. RAMSBOTTOM & Co. LTD., Keighley, Yorks.

Rotary Converter, 230 d.c., 230 a.c., 80 watt, £7 10s. 0d.—BURNETT, 171, York Way, London, N.7. GUL 7274.

Small A.C. Motors, by A. H. Avery, A.M.I.E.E. A practical handbook describing types, running characteristics, starting arrangements and the general applications of fractional horse-power alternating current motors with rules for the estimation of new windings. 3s. 0d. from your bookseller or 3s. 3d. post free from—PERCIVAL MARSHALL & Co. LTD., 19-20, Noel Street, London, W.1.

SITUATIONS

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

Required for New Factory. Milling machine department "foreman" take complete control 12-15 mills of all types. Only highly skilled man, complete master of the mill used to precision work on competitive times and well versed in feeds and speeds together with all types of modern cutters considered. Five day week, plenty of overtime, sick pay, contributory life insurance and pension schemes in operation "after proving." Salary in accordance with ability, but secondary to "real ability." State full industrial history and full school details.—BALDING ENGINEERING, Duke St., Norwich.

GENERAL

"Spraying Handbook" 1950 ed. Car, caravan, industrial, domestic stoving, flock leather spraying, 3s. 6d. post free.—LEONARD BROOKS, 25, Harold Wood, Romford.

"Aqualung" Cylinders, £2, 2s. 6d. Regulators, £1 16s. 9d. Compressors, £4 10s. 0d.—PRYCE, 157, Malden Road, Cheam.

Guaranteed! Easy Home Constructed Refrigeration. Genuine domestic components. Not second-hand ice cream scrap. Modern hermetic G.E.C. units. Gas, electric and oil silent units. Everything for refrigeration. Complete specialists. Send s.a.e. for free illustrated "Sealed System" leaflet or 1s. for complete catalogue (refunded with first order).—BRAID BROS., 50, Birchwood Avenue, Hackbridge, Surrey. Phone: Wallington 9309.

Watch and Clock Lathes, cleaning machines, staking tools, etc. (Large illustrated catalogue, 1s. 6d. p.p. price list 1s. 1d. p.p.). Stop watch and chronograph repairs and materials for the trade. Special offer. New (slightly soiled) 2½" Burnerd 3-jaw (reversible) scroll chucks, £3 11s. 9d. post paid. (Used 6, 6½, 8 and 10 mm. lathes bought, sold and part exchanged.) Easy payment terms available.—JOHN MORRIS (CLERKENWELL) LTD., 64, Clerkenwell Road, London, E.C.1.

Compressor Equipment, miscellaneous items, etc., catalogues, 1½d.—PRYCE, 157, Malden Road, Cheam.

Rubber moulds for plaster ornaments, from 2/- each. Moulding compound for mould making 8/6 per lb. Granulated ready for use. 1,000 varieties of moulds for solders, etc., from 3/- each.
S.A.E. for list. 9d. for catalogue.
F. W. NUTHALL
69, St. Marks Road, Hanwell, London, W.7

Compressors for Sale. Twin pistons complete with air receiver, driving wheel and motor cradle, 180 lb., 2½ cu. ft., price, £3. Also 8 cu. ft. compressor only, £5. Motors a.c. and d.c. all types, ¼ h.p., £3. Carriage forward.—WHEELHOUSE, 1, The Grove, Isleworth, Middx. Phone: Hounslow 7558.

Musical Mechanisms. Swiss-made for fitting in cigarette boxes, etc., 17s. each. Send s.a.e. for complete list of handicraft materials.—METWOOD ACCESSORIES, Dept. M.E., Church Street, Wolverton, Bucks.

Air Compressor Units, 2½ to 18 cu. ft., 100 to 800 p.s.i. from £4 17s. 6d. Stationary and mobile plants from £16 17s. 6d.—Below.

Air Tanks and Accessories at approximately 50 per cent. off lists.—Below.

TV Generators and Lighting Sets "Chorehorse" BD-12-A, £47, 10s. 0d. "Onan" relays starting from £37 10s. 0d. "Homelite" £35 0s. 0d., etc., all with d.c. output. Straight d.c. lighting sets "Delco" £16 10s. 0d. Johnson "Chorehorse," £25. "Homelite" 24 volt, 2,000 watts, £27 10s. 0d. —TEDDINGTON ENGINEERING CO. LTD., Dept. G., 29/31, High Street, Teddington, Middx. KINgston 1193.

Clutches. New and reconditioned, 2-speed, vee drive units from £3 5s. 0d. Postage, packing extra.—CHORLEYS, 41-42, Beech Street, London, E.C.1.

Build Your Own Refrigerator. All components available at reasonable prices. Frigidaire, "Flowing Cold" units, £5; small single-cylinder units, Kelvinator, etc., £4; ¼ h.p. heavy duty motors, £3. Chrome cabinet fittings new, £4 set. Money back guarantee. S.A.E. for list and schematic diagram.—WHEELHOUSE, 1, The Grove, Isleworth, Middx. Hounslow 7558.

Spare Time Profit. Plastic injection moulding machine, suitable for the craftsman, small manufacturer and those interested in hobbies and education. Apply: —DOHM LTD., 167, Victoria Street, London, S.W.1. Tel.: VICtoria 1414.

Mild-Steel, Aluminium and alloy, brass, tool-steel, castings, etc., widest range, 4-way toolposts, from 1½" square, 6d. lists.—SYNEK, 73, Sherbrooke Road, London, S.W.6.

Build Your Own TV and learn about its operation, maintenance and servicing. Qualified engineer-tutor available whilst you are learning and building. Free brochure from—E.M.I. INSTITUTES, Dept. M.E.58, London, W.4. (Associated with H.M.V.).

THE MODEL ENGINEER SUBSCRIPTION FORM

In some parts of the world readers of *The Model Engineer* may experience difficulty in obtaining their copies regularly, in which case it is advisable for them to become annual subscribers. An International Money Order for £2 2s. 0d. Sterling may be purchased in the currency of the country concerned at most banks and post offices; this should be forwarded to us with the form below duly completed.

Please send a copy of *The Model Engineer* each week to:

Name .....
(Block letters please)

Address.....

.....

I enclose £2 2s. 0d. to cover subscription for one year (52 issues). This includes postage.

POST THIS FORM TO

THE MODEL ENGINEER, 19-20, Noel Street, London, W.1

Easy to Make Clutch Unit Drawings, instructions, all parts only 68s. 6d. Leaflet free.—P. B. ENGINEERING, 86, King William Street, Coventry.

Bumble Bee & Busy Bee, 50 c.c. auxiliary engines by Edgar T. Westbury. Send s.a.e. for lists of our super castings and all accessories for these engines.—BRAID BROS., 50, Birchwood Avenue, Hackbridge, Surrey. Telephone: Wallington 9309.

Machining and Fitting Service. All work to toolmakers' standard. Reasonable charges. Good delivery. Estimates free.—RANKIN ENGINEERING, 103, Gordon Road, Gillingham, Kent.

How To Make Marquetry Pictures, by J. Anderson. Various methods are described and the making of a picture is illustrated stage by stage. The book shows how photographs can be used as a basis for attractive marquetry work. Lavishly illustrated. 4s. 6d. from your bookseller or 4s. 9d. post free from—PERCIVAL MARSHALL & CO. LTD., 19-20, Noel Street, London, W.1.

Designers and Manufacturers of jigs, tools and press tools. Model and light engineering work also undertaken.—GEO. J. BLAKE, 27, Campbell Road, Maidstone,

Wanted. ¼ h.p., a.c. motor. One self-centring chuck for Super Adept lathe. One small rotary pump.—Box No. 7736, MODEL ENGINEER Offices.

Selling. Model Engineer Vols. 84-91 bound. 83, 94-103 unbound. S.A.E.—Box No. 7740, MODEL ENGINEER Offices.

Model Engineer, Vols. 102-111, unbound, clean, 10s. per volume.—BARTER, 15, Goldington Avenue, Bedford.

Engineer Retired wants work, fitting, experimental, 3½" lathe.—Box No. 7742, MODEL ENGINEER Offices.

Watch Repairing and Adjusting, by W. L. Randell. Explains simply and in detail, the various parts and their function. The reader is led on to the repair and adjustment side only after he has learned how the watch works. 3s. 6d. from your bookseller, 3s. 9d. post free from—PERCIVAL MARSHALL & CO. LTD., 19-20, Noel Street, London, W.1.

Wanted. Friez (Baltimore) flight analyser. Details to—WHITFIELD, Manor Farm, Coton, Cambridge.

Build Your Own Dish Washing Machine for fraction of market price. Cabinet, etc. available. Easy to follow plans, full instructions, 5s. only. Bargain. Genuine labour saving machine specially designed for home construction. P.O. to—BM/KSVJ, London, W.C.1.

E.M.I. Disc Recorder, 2,300, complete with microphone, spare cutters, blanks, etc., as new, cost £245, £150 o.n.o.—11, Streatham Vale, S.W.16. Pollards 3568.

Unique Sale Bound Volumes, 1 to 79 "Model Engineer" offers as one lot. Buyer collects.—27, Wandle Road, S.W.17. Balham 5988.

Edinburgh and District. Owner of 7¼" and 5" gauge model railways would welcome assistance of keen model engineer, week-ends. —GRAHAM, Longformacus, Berwickshire.

Blocks. Fully Seasoned fine grain cast-iron blocks, ground all over, 18" × 3" × 2" each in wooden box. Only 100 available. £5 value at 20s. each collected, 5s. extra carriage paid.—BLACKFRIARS PRECISION LTD., 154/6, Blackfriars Road, London, S.E.1. WATerloo 3131 (5 lines).

B.M. Steel Flats. ⅛" thick, 6" wide, 3s. 6d.; 5", 3s. 2d.; 4½", 2s. 10d.; 4", 2s.6d.; 3½" 2s. 2d.; 3", 1s. 8d. per ft. Over 150 sections of steel and brass in stock. S.A.E. for list.—B. J. HARRIS, The Cottage, Corngreaves Hall, Cradley Heath, Staffs.

How To Make An Electric Clock, by R. Barnard Way. Shows how a simple mains or battery-driven clock can be constructed cheaply by the ingenious use of simple, everyday materials. 3s. 6d. from your bookseller or 3s. 9d. post free from—PERCIVAL MARSHALL & CO. LTD., 19-20, Noel Street, London, W.1.

Classified Advertisements

PRIVATE RATES

One week . . . . 3d. per word

THREE weeks . . 6d. per word

MINIMUM 12 WORDS ★ USE OF BOX No. . . 1/-

THE MODEL ENGINEER

CLASSIFIED ADVERTISEMENTS

- PRIVATE RATE **3d.** A WORD
- TRADE RATE **6d.** A WORD
- MINIMUM 12 WORDS
- BOX NUMBER **1/-** EXTRA

To "THE MODEL ENGINEER" Classified Advertisement Dept., 19-20, Noel Street, London, W.1

Please insert the advertisement below under

heading.....for.....insertions

Name .....

Address .....

Name and address, if to appear, must be paid for.

Three insertions for the price of two. ★ Private advertisers only.

Please write in block letters. REMITTANCE VALUE ..... ENCLOSED

"WEB" MODEL FITTINGS WIN ON QUALITY

AND THIS IS THE MARK THAT PROVES IT

A limited amount of fully illustrated catalogues, 48 pages of "WEB" Model Productions, faithfully reproduced from the actual models. Well over 1,000 sizes to choose from. Price 3/- post paid.
Whether you require fittings for Yachts, Sailing Ship, Launch, Liner, Naval or Marine, our excellent productions are produced to give you entire satisfaction at a reasonable price. If you have difficulty in obtaining our products, send your order to our works. We regret that NO enquiries can be answered unless a stamp is enclosed for return postage.

THE WEB MODEL FITTING CO.
204, High Road, Wood Green, London, N.22, England

SPECIAL PURCHASE

TERRY LAMPS
Ex A.M. spring-friction Anglepoise type with pygmy reflector and s.b.c. holder. Wall/bench fitting—UNUSED and perfect 31/6. Under half cost. Post extra 1/6.
EXTRAS NOW AVAILABLE (Not Terry Products) Larger Reflector and b.c. holder for all standard bulbs 5/9. Cast Iron Table Base (weight 9 lb.) 8/6.

31/6

MONEY BACK GUARANTEE
CHARLES FRANK
67-73 SALTMARKET, GLASGOW, C.1
Est. 1907 Phone: Bell 2106-7

PRECISION GEARS

Spur Gears — 24-100 D.P.
Bevel Gears Mitre & Ratio,
Worm Gears and Reduction Boxes,
Crossed Helical Gears — Racks,
Ground Shafting — Collars — Ratchet Wheels.
Send for complete list. *Phone* 20231-2

Made by S. H. Muffett, Ltd. Estd. 1920
PRECISION PRODUCTION ENGINEERS
Mount Ephraim Works, Tunbridge Wells

The ANNUAL SUBSCRIPTION to
THE MODEL ENGINEER
is £2-2-0 post free

It is published every Thursday and is obtainable from local newsagents or from the publishers direct (by subscription)

PERCIVAL MARSHALL & CO. LTD.
19-20, NOEL STREET, LONDON, W.1

ONLY A FEW SETS LEFT—ORDER NOW!

Pregrouping Locomotive Albums

Consisting of five 4 pp. Albums, each 11" x 9", printed on high-grade art paper. Engines are depicted in the actual railway livery colours used by the company concerned, with enlarged illustrations of the colour scheme adopted. All historical and technical data is given with a specification table showing leading dimensions and weights. There is also a set of 4 mm. scale drawings showing plan with front and side elevations. These are wonderful value for the railway enthusiast. There are only a small number left and the albums will not be reprinted. Send now while sets are still available.

- ★ L. & N.W.R. 2-4-0 locomotive No. 619 "Mabel"
- ★ S.E. & C.R. 4-4-0 locomotive No. 736
- ★ G.N.R. 4-2-2 locomotive No. 5
- ★ L.B. & S.C.R. 0-4-2 locomotive No. 189 "Edward Blount"
- ★ G.W.R. 4-2-2 locomotive No. 3046 "Lord of the Isles"

ONE SHILLING post free the set of five from:

PERCIVAL MARSHALL & CO. LTD.
19-20 Noel Street, London, W.1

Printed in Great Britain for the Proprietors by ELECTRICAL PRESS LTD., Cordwallis Works, Maidenhead, Berks, and published by PERCIVAL MARSHALL & CO. LTD., 19-20, Noel Street, London, W.1.
Registered for transmission by Magazine Post to Canada including Newfoundland.

Why not exhibit

Your Model

AT

The MODEL ENGINEER EXHIBITION

AND THE

EXHIBITION of INVENTIONS

NEW HORTICULTURAL HALL

Westminster • August 17-27

Model Engineers from all over Britain get together for this great annual event. The Competition Section is open to all, and there are a number of cups and medals to be competed for in addition to diplomas, cash vouchers and workshop equipment. Of particular interest to model engineers are the:

RAILWAY SECTION

Locomotives, 2½ in. gauge and over; locomotives, 1¾ in. gauge and under; rolling stock and accessories.

GENERAL ENGINEERING SECTION

General engineering models (including marine engines); internal combustion engines; mechanically propelled road vehicles (including tractors); racing cars (self-propelled); tools and workshop appliances; engineering scale models (non-working); scenic and representational models (including architecture); horological, scientific and optical apparatus; general craftsmanship—not otherwise classified.

THE STUDENTS' CUP

Awarded for the first time at The Model Engineer Exhibition last year. Any piece of model engineering work made collectively or individually by a class or member of a class of any school or technical college, or by a full-time engineering apprentice under the age of 18 at the time of the exhibition, will be eligible for entry.

CLUB TEAM CHAMPIONSHIP

Clubs wishing to compete should enter three or more exhibits (in any class) made by regular members. Out of each Club's exhibits, those three gaining the highest marks will automatically represent the Club in the championship.

THE DUKE OF EDINBURGH TROPHY

Open to previous winners of cups or models at the Exhibition.

There is also a Marine Section for model ships, steamers and powered boats, a Model Aircraft Section and a Junior Section. The Junior Section is open for entry of any type of model or mechanical work by a child under the age of 16 at August 17th, 1955.

Competition entry forms and further information are available from the Exhibition Manager, 19-20, Noel Street, London, W.1.

THE FINAL DATE FOR ENTRIES IS:

Monday, July 11th

Portable, robust all-purpose 8" Circular Saw

at a sensible price

£44/10

(motor extra as required)

Each machine fitted with combination rip and crosscut blade. Also available are FINE TOOTH CROSSCUT, PLANER BLADE, CARBORUNDUM BLADE.

A precision machine for cutting wood, plastics, hardboard and asbestos.

SENIOR SLYKSAW

★ Automatic belt tension with single lever for raising and lowering saw ★ Table tilts to 45 deg. ★ Totally enclosed drive ★ Ball bearing spindle ★ Ball bearing spring loaded jockey pulley ★ Fine adjustment to fence ★ Rigid cast iron table machined on face and sides with machined slots for mitre fence ★ Sawdust chute at rear ★ Easily transportable for site work.

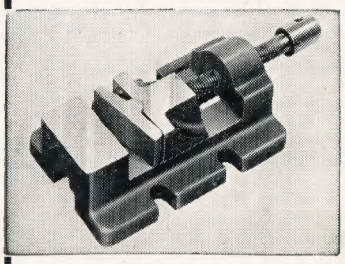
Pushbutton starter is included and built in.
Immediate delivery.

Write for full details to :

J. & H. SMITH LTD.

Dept. ME7, 16 HARRISON STREET, LEEDS 1. Phone: 21561

ML7 & SUPER 7 LATHE ATTACHMENTS



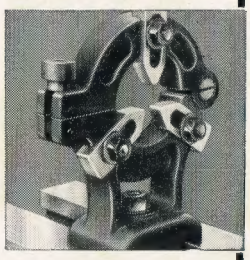
MACHINE VICE

VERSATILITY

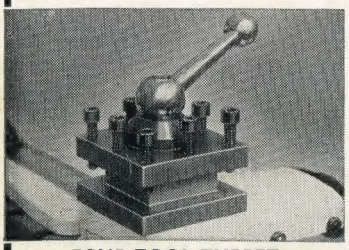
The potentiality of the Myford Lathe is greater than any comparable machine. An extensive range of attachments and accessories (over fifty), specially designed for these two machines, make them the most versatile lathes today.

Every machine leaving the Factory is prepared, drilled, tapped, etc., where necessary to accept at any time such fitments as Travelling Steadies, Taper Turning Attachments, Thread Dial Indicators, Gearbox, Leadscrew Handwheels, etc., etc. Other items for example are :—Machine Vices which are designed to fit on Boring Tables, Vertical Slides, Faceplates, etc. Screwed body chucks, which avoid the necessity of chuck backplates. Inexpensive Collet attachments avoiding the restriction of a Draw Tube, etc., etc.

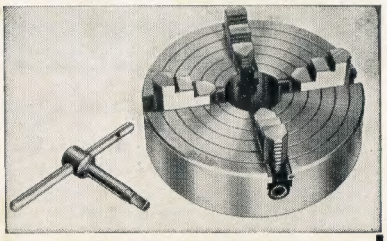
Send for Details NOW!



STEADY



FOUR TOOL TURRET



SCREWED BODY CHUCK

MYFORD ENGINEERING CO. LTD · BEESTON · NOTTM

A useful and easily cleaned machine for buffing, grinding and polishing. Shaft has false noses and handles for quick ejection when changing heads. A rotary switch for high and low speeds is fitted in the base. Sleeve bearings are standard and dust excluders are fitted. High-class cream finish.

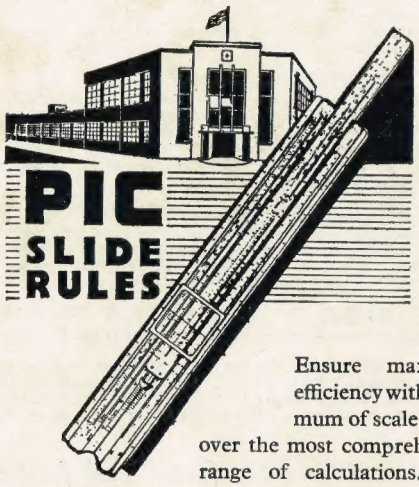
Speeds - 2,850 r.p.m. and 1,428 r.p.m. on load, giving outputs of 1/3rd h.p. and 1/6th h.p. according to speed.

BROOK GAYPHON FRACTIONAL HORSE POWER MOTORS

BROOK MOTORS LIMITED

HUDDERSFIELD

55/A



Ensure maximum efficiency with minimum of scale length over the most comprehensive range of calculations. No other slide rule—British or foreign—offers the same or equal advantages.

Our Illustrated Catalogue giving particulars of P.I.C. Slide Rules, Drawing Instruments, etc., is sent free on request.

A. G. THORNTON LTD.
Drawing Instrument Specialists
WYTHENSHAWE, MANCHESTER.
Tel: WYThenshawe 2277 (4 lines)